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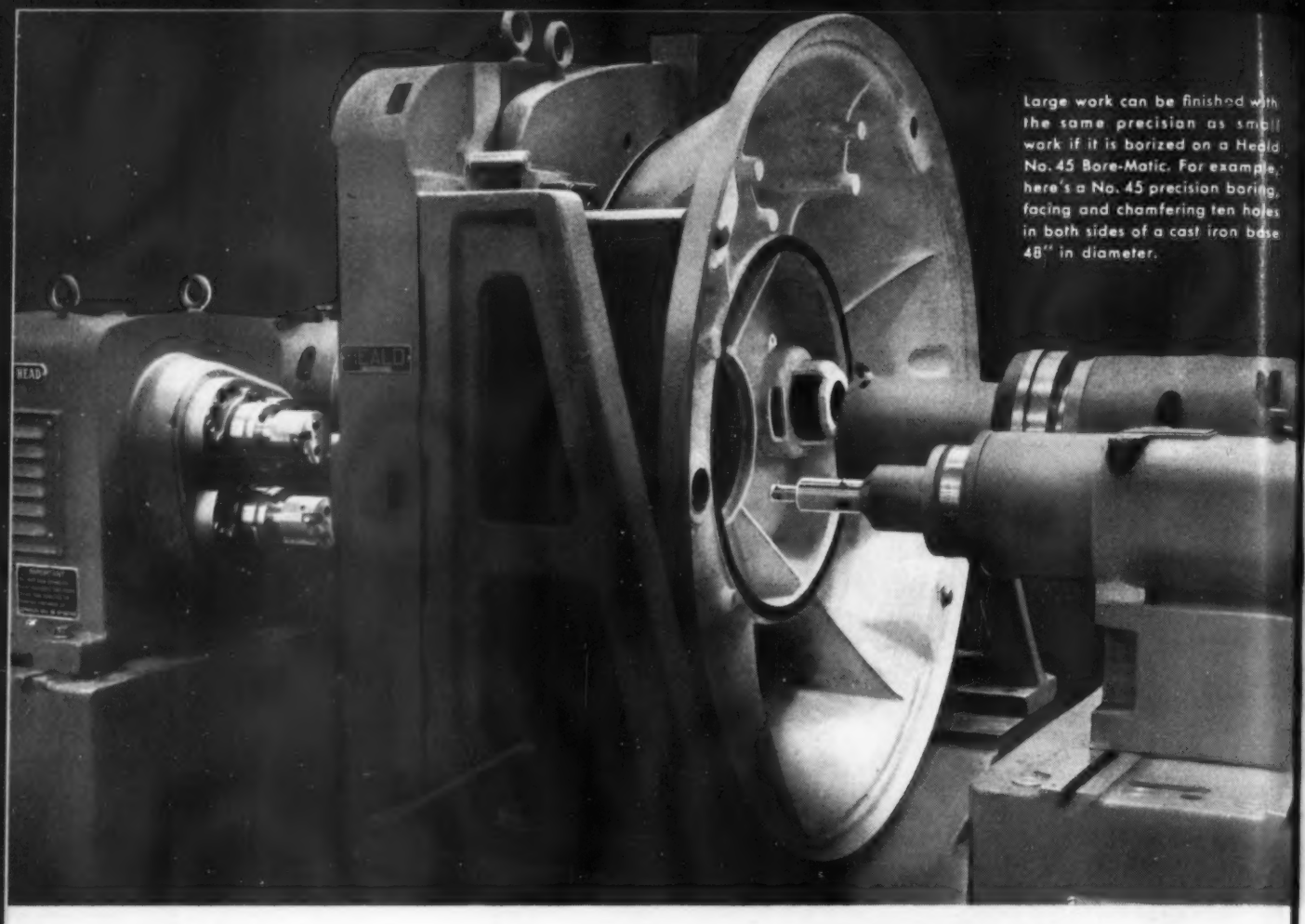
Plastic Molding Methods



Large work can be finished with the same precision as small work if it is borized on a Heald No. 45 Bore-Matic. For example, here's a No. 45 precision boring, facing and chamfering ten holes in both sides of a cast iron base 48" in diameter.

HEAVYWEIGHT *with a Feather Touch...*

Get High Precision On Your Large Work With This Heald No. 45 Bore-Matic

13,000 lbs. of "heavyweight" machine tool... that's a lot of mass, a lot of rigidity, and gives some indication of the size and ruggedness of the Heald No. 45 Bore-Matic. Built specifically for large, heavy awkward parts, the No. 45 is *big* but still incorporates all the proven features of Bore-Matic construction for "feather-touch" high precision borizing.

Holes up to approximately 9" I. D. can be bored. Center-to-center distance of borized surfaces to 31" is possible. Double-end No. 45's provide standard maximum table stroke of 30", single-end machines 16". Table pads have ample area to accommodate work fixtures or tooling—36"x 40" on the Double End machine; and 36"x 36" on the Single End. Distance between bridges on the Double End is 52".

This big, massive Bore-Matic is available in either single or double end types. The two types are built low, tables being only 22" from the floor at conveyor level, to facilitate handling of heavy, awkward work. For further details, write today to:

THE HEALD MACHINE COMPANY
WORCESTER 6, MASS.

· *More Precision · Less Cost...* **HEALD**

INTERNAL AND SURFACE GRINDING MACHINES • BORE-MATIC PRECISION FINISHING MACHINES

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RETURN POSTAGE GUARANTEED

VOLUME 89 NUMBER 12

AMERICAN MACHINIST. Copyright 1945 by McGraw-Hill Publishing Co., Inc. Published every other Thursday, price 35c a copy. Allow ten days for change of address. Subscription rates—United States, Mexico and Central and South American countries. $5 a year, $8 for two years, $10 for three years. Canada, $6 a year, $10 for two years, $12 for three years. All other countries, $10 a year, $16 for two years, $20 for three years. Please indicate position and company connection on all subscription orders. Entered as second class matter, August 13, 1943, at Post Office, New York, N. Y., under the act of March 3, 1879. Printed in U. S. A. Cable address, "McGraw-Hill, New York." Member of A.B.P. Member of A.B.C.

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MAJOR ARTICLES

Milling System Decreases Inventories.....*Arthur A. Schwartz* 99
Transfer Molding of Plastics.....*D. M. Buchanan* 103
Precision Bevel Gears Cut Quickly.....*Ernest Wildhaber* 106
Lubrication by Color Code System.....*H. W. Helms* 110
Friction Sawing Proves Faster.....*R. C. Holloway* 113
Russia and America Allies—or Else.....Facing Page 112
Diamond-Pin Calculations.....*Edward J. Chartier* 121
Tooling Ways Locates Points in Space..... 122
Short Cuts for the Small Shop.....*A. H. Waychoff* 125
Good Welds in Magnesium.....*F. Masdeo* 126
The Foreman Can Help the Service Man.....*Frank Warren* 130
Foreign Standards for Metric Threads.....*John Gaillard* 133

PRACTICAL IDEAS

Quadrant Seam Welds Curves.....*Oliver Doutt* 115
Three-Point Contact Centers Tubes.....*Oscar I. Craft* 115
Bandsaw Roller Guides.....*Herman J. Nohl* 116
Exhaust Hood Cools Rivet Gun.....*Carl Peterson* 116
Targets Locate Assembly Coordinates.....*Seth Evans* 117
Welding Clamp for Sharp Corners.....*Clifford Brown* 117
Ratchet Feed Replaces Pawl Feed.....*Lawrance J. Despierre* 118
Spring-Cushioned Instrument Cases.....*V. B. Kuzmich* 118
Carbide Inserts for Grinder Workrest.....*H. B. Pratt* 119
Billet Chuck for Large Bars.....*George C. Foster* 119
Torch Tips Reconditioned.....*G. T. Hayes* 120
Circular Forming Tools for Grooving.....*Charles A. Bertang* 120

NEWS OF THE INDUSTRY

Gaging Business 140a
Detroit Letter 140c
Washington Bulletin..... 140e
Spotting the Air News.... 140f
Names in the News..... 140g
Obituaries 140h

DEPARTMENTS

Editorial 97
Reference Book Sheet 137
Shop Equipment News..... 141
Trade Publications..... 156

CHANGE OF ADDRESS ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

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Big Event . . . Sometime ago we notified you that *American Machinist's* 1945 version of the 5-Year Inventory of Metal-Working Equipment was in the making. It is with considerable pleasure that we announce the publication of this important research project in the July 5 issue of *American Machinist.*

In a special 16-page section, we will reveal the total number of machine tools and other key items of Metal-Working equipment now installed in the United States. Figures will be given by geographical distribution as well as by type of industry in which they are being used. The number of units over 10 years old will be indicated, as well as much other information of immediate and vital concern to the Metal-Working industry.

This study has been conducted every 5 years since 1925 and we truly believe it was never needed more than today. With reconversion and postwar plans being dusted off and brought up-to-date in virtually every manufacturing plant, facts such as the 1945 Inventory will prove most timely and useful in determining where we stand and where we go from here.

Preliminary checks have assured us that this Inventory is more extensive and more accurate than any of its predecessors and we certainly hope you will give it a thorough study.

Reprints will be made available and we will be very interested in any comments you may have.

It Can Happen Here . . . To those who may think that intelligent management and the patriotic spirit of workers are remote ideals, we submit the following true story:

It was V-E Day, and most of the plants in an industrial section of a certain eastern city were closing down. The president of a prominent gear manufacturing firm, undecided as to what to do, finally announced that his plant would keep running in the morning and workers would be given the afternoon off to celebrate.

As the news percolated through the plant, a delegation of employees came to the president and insisted that since they had relatives still fighting in the Pacific they wanted to stick to their jobs all day.

"O. K.", said the boss promptly, "all those who want to stay may do so and I will pay you double time in view of the spirit you are showing."

It finally developed, as a result of this combination of shrewd handling and employee spirit, that about two-thirds of the workers in the entire organization put in their regular day.

American Machinist Chips

Doubting Thomas . . . Some months ago we ran a little item in this column reporting, from the house publication of Joshua Hendy Iron Works, a new method of cutting gears . . . as developed by navy experts working with that firm. The essence of the story was that they produced a composite hob with a steel body and strips of interchangeable carbide teeth—enabling the hobbing machine to be operated at 100 revolutions per minute instead of the usual 35. Subsequently, we received the following letter:

"You showed good judgement in crediting this to the 'house publication.' However, you should have a 'humor department' to run such stuff in. Some of the questions that are apt to be asked by your readers are:

"Who were these navy experts? Any one doing something like this should have his name in PRINT. Were the teeth actually made of 'carbide'? (Now be real honest about this one) Were the strips actually interchangeable? Oh yes, and how did they sharpen the hob after it became dull? Why could it not also be used for the finishing cuts?"

Yours truly,
Lewis N. Stewart
Melrose Park, Ill.

Unfortunately, we recently donated to the paper salvage the Hendy magazine containing the article in question, and are unable to answer from memory the questions Mr. Stewart brings up. It may be that in giving you a brief report of this tooling feat we omitted some details which would have made the matter clearer. However, we suggest to Mr. Stewart and any other interested parties that they write to the editor of *Iron Men of Hendy,* Joshua Hendy Iron Works, 206 Sansome St., San Francisco, California. We are quite sure that, unless the details are military or trade secrets the Hendy people will be glad to answer the above questions.

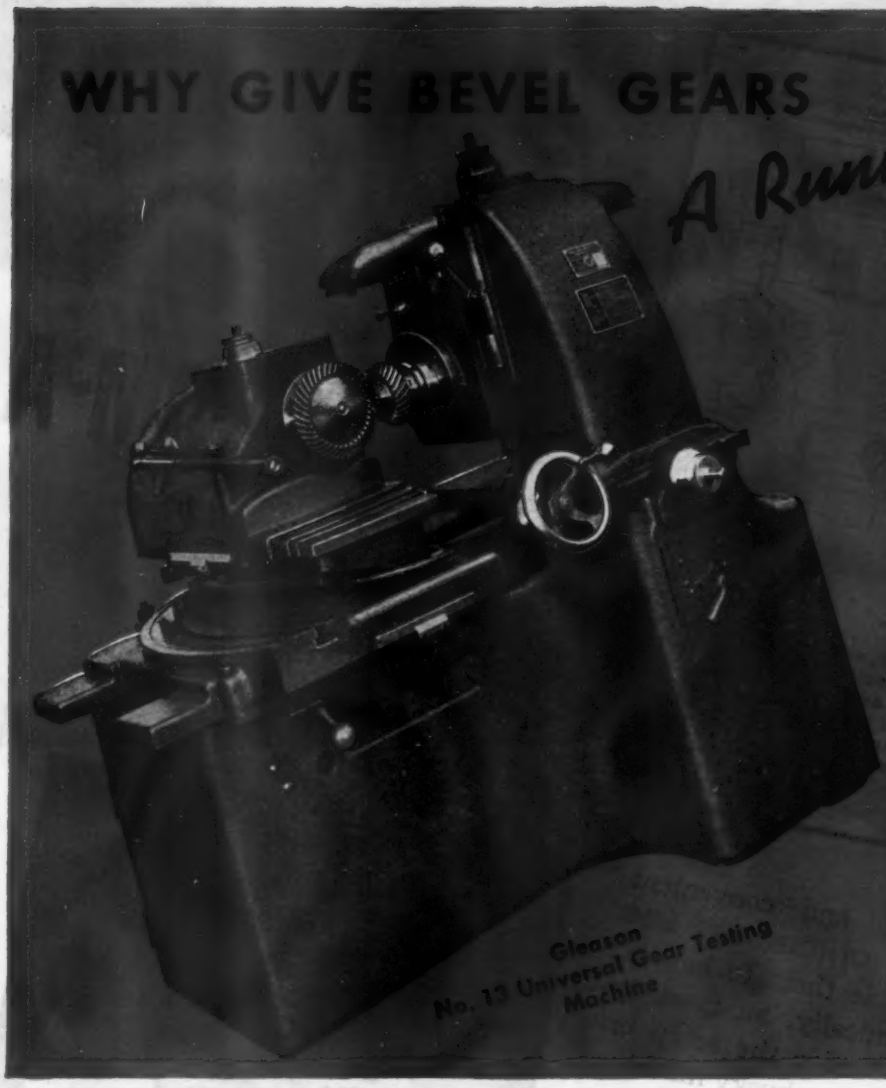
D. P. C. Tools . . . A letter from Wigglesworth Machinery Co. of Cambridge, Mass., states particular interest in the "Defense Plant Corporation Machine Tool Inventory" as reported in the April 12 issue of *American Machinist.*

This was an outstanding "scoop" achieved by our alert Washington editor, and we have received many enthusiastic comments from firms who are trying to gage the postwar machine tool situation. This very specific report is available to you as a reprint . . . no charge for single copies or limited quantities as long as they last.

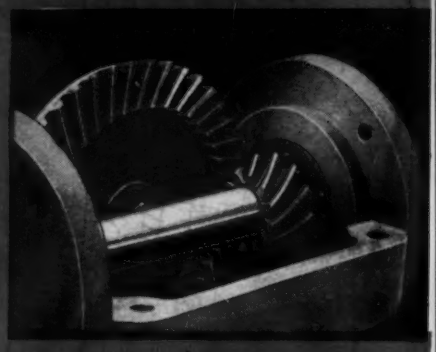
Tooling Job . . . One of our glamorous secretaries spotted the following tidbit in the recently-published book "Try and Stop Me" . . . an hilarious collection of anecdotes by Bennett Cerf. This one was told about the playwright George Kaufman:

A guest expressed concern at the fate of all the women war workers when the boys come marching home. George had a ready solution. "Keep the women on the job," he suggested, "and let the men stay home and have the babies. All that is necessary is a certain amount of retooling."

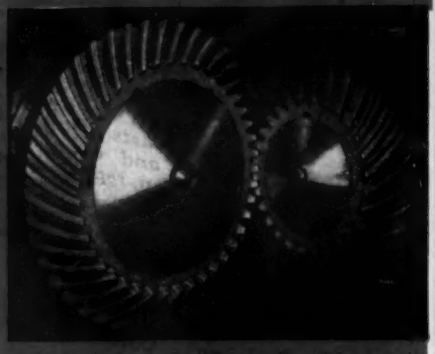
WHY GIVE BEVEL GEARS A Running Test?



Gleason No. 13 Universal Gear Testing Machine



Spiral bevel gears in final mountings showing actual tooth contact



Spiral bevel gears in Gleason Testing Machine showing desired tooth contact for proper operation of gears in final mountings

Bevel gear users must know how their gears will operate in their final mountings. Gleason testing machines provide a practical method of insuring that the gears are right before expensive assembly. In these testers the gears are rigidly mounted in the correct operating position and run under power and brake load. By means of machine adjustments it is possible to determine how the gears will operate in and out of position in their final mountings.

Tooth size, pronounced run-out and tooth spacing error, smoothness and quietness of operation, and actual tooth contact under load (known as tooth bearing) are all checked by the running test. This test is important for all types of gears, but it is essential for the tapered teeth of bevel gears, which can not be checked for shape in any other practical manner.

In all stages of gear manufacture the running test gives a positive indication of how the gears will operate in their final mountings. This check is invaluable:

Before Production — to determine correct set-up of gear cutting machine.

During Production — to maintain uniform quality of the production gears.

Final Test — to find the best running position of the gears for assembly.

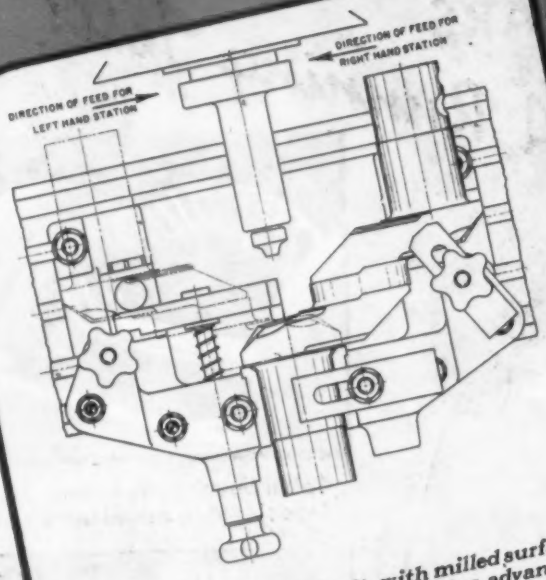
— to eliminate "fitting" or "tearing down" and rebuilding of an assembly, because the gears are not right. Substantial savings in time and expense result.

Send in prints of your gears to the Gleason Works. We will be glad to recommend the testing machine best suited to your needs. The Gleason Works, Rochester 3, New York, U. S. A.

HEAVY FIXTURE AND

. . . FROM A

CINCINNATI



Sketch of rear crankshaft, with milled surfaces indicated in color. This setup takes advantage of the 1-18's two-way automatic feed cycle. All the parts are milled on one side, then the cutter and clamps are changed, and the operation repeated for the other side.

The rigid construction and convenient operational features of CINCINNATI 1-18 Automatic Millers enable them to handle, accurately and economically, an unusually wide range of parts. Notice the setup on the opposite page. It takes a husky machine with a sturdy table drive to rapid traverse a heavy load like this from a dead stop to 300″ per minute. And it takes a rugged spindle mounting to support the long cutter extension required for the milling operation. You may think it is expecting too much from a small machine, but CINCINNATI 1-18's are built to take it, year after year, and give dependable performance. Investigate this versatile machine for the milling operations in your shop. Our engineers will be glad to talk it over with you.

CINCINNATI 1-18 Plain Automatic Milling Machine. Complete specifications are contained in Catalog M-848. Sweet's Catalog File gives a brief description of this miller.

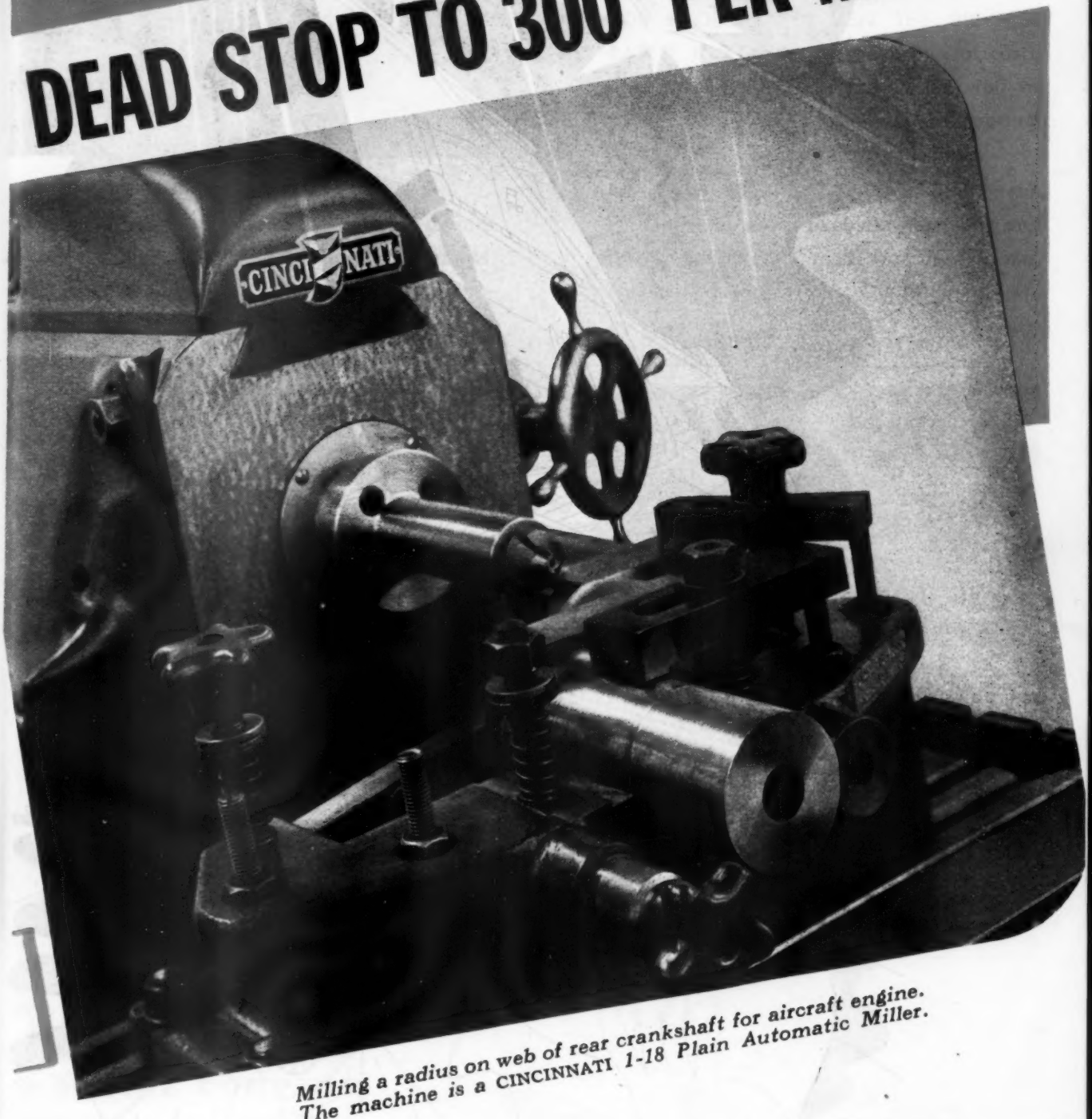
It's the lucky seventh
BUY AN EXTRA BOND!

THE CINCINNATI

MILLING MACHINES

WORK ADVANCED TO CUTTER

DEAD STOP TO 300" PER MINUTE



Milling a radius on web of rear crankshaft for aircraft engine. The machine is a CINCINNATI *1-18 Plain Automatic Miller.*

MILLING MACHINE CO. CINCINNATI 9, OHIO, U.

BROACHING MACHINES • CUTTER SHARPENING MACHINES

etienne

you wouldn't

lift a 500 pound load with a 100 pound capacity rope

It is just as foolish to put carbide cutting tools on an out-moded lathe. Carbide tools have increased horsepower requirements as much as 300 per cent.

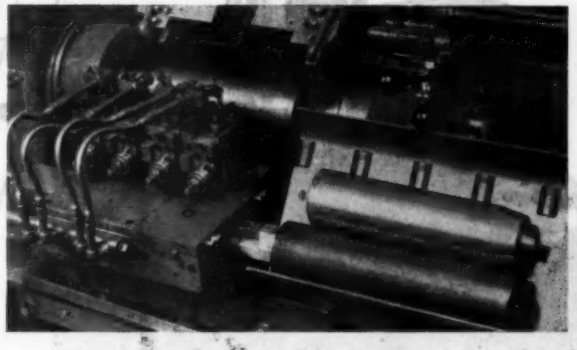
Modern Jones & Lamson Lathes are designed specifically to carry this extra load, and more. They have the power, they have the rigidity, they are easy to operate.

FOR PRODUCTION MEN THE BIGGEST BATTLE LIES AHEAD—the battle of costs. Our jobs, and our earnings, as well as profits, will depend upon maximum production from the most efficient machines.

Now is the time to check your equipment. Plan now to scrap obsolete machines and replace them with good War Surplus machines or new machines. Our engineers will be glad to assist you.

What HORSEPOWER Are You Using?

The 16" Fay Automatic Lathe that is rough turning this 105 millimeter shell has to transmit *from 75 to 100 horsepower* to do this job on a production basis and take full advantage of the fast cutting carbide tools.



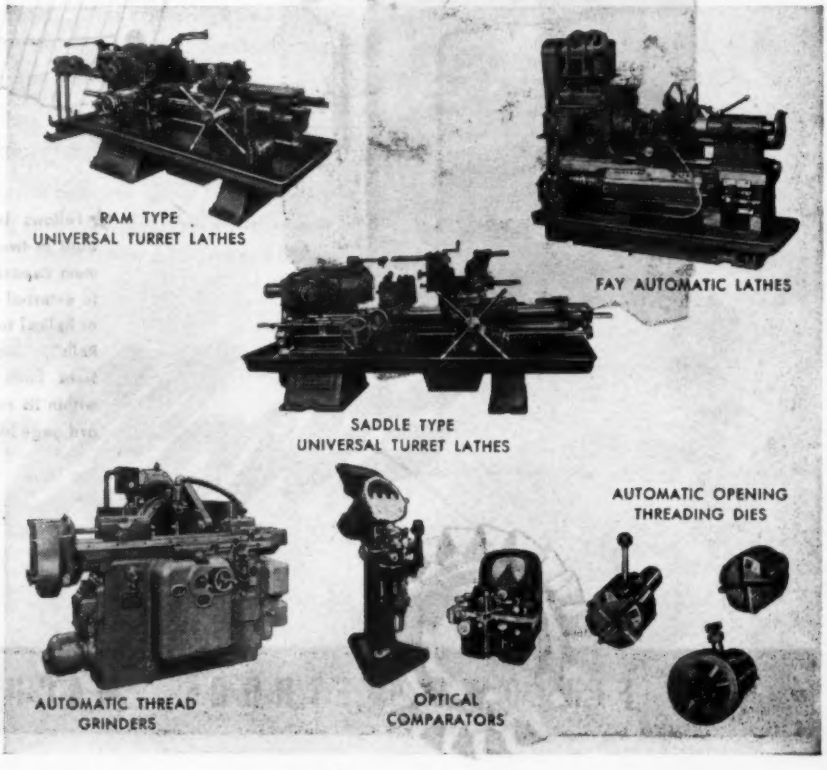
Engineered to "Carry the Load" for Most Productive Operation With Carbide Cutting Tools

Fay Automatic Lathes

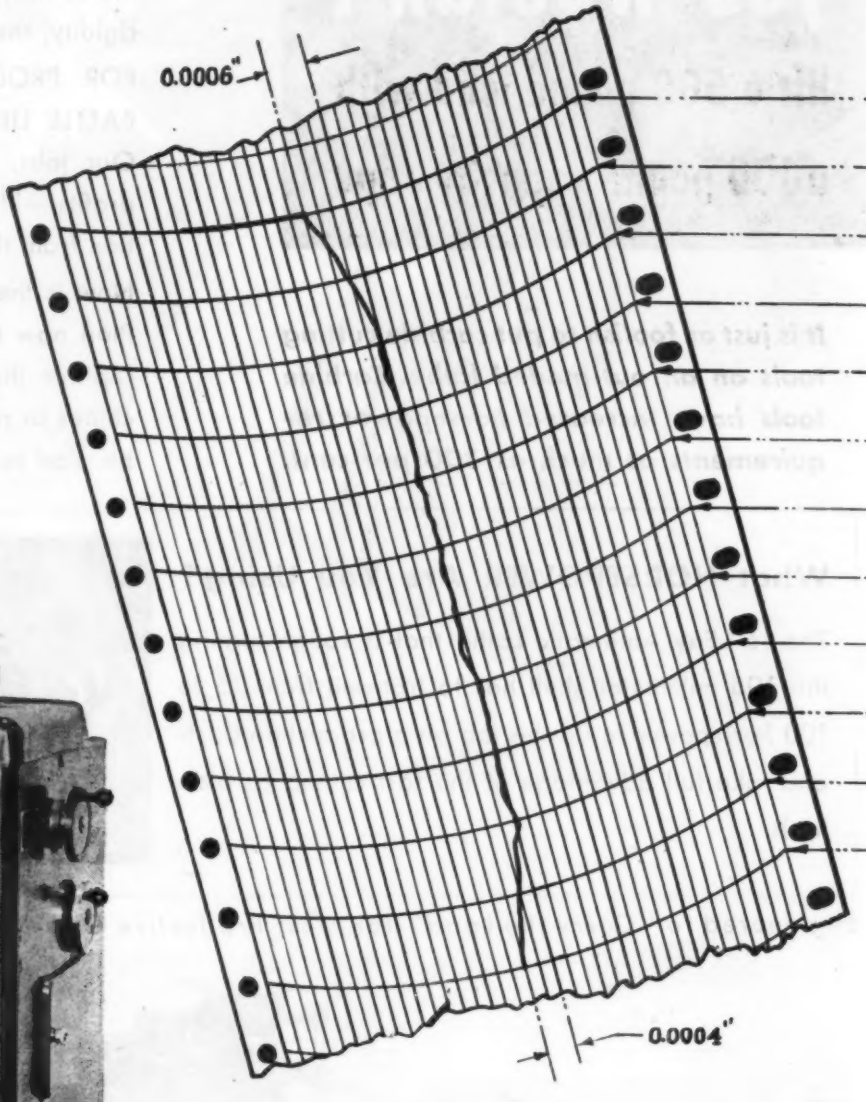
JONES & LAMSON
MACHINE COMPANY

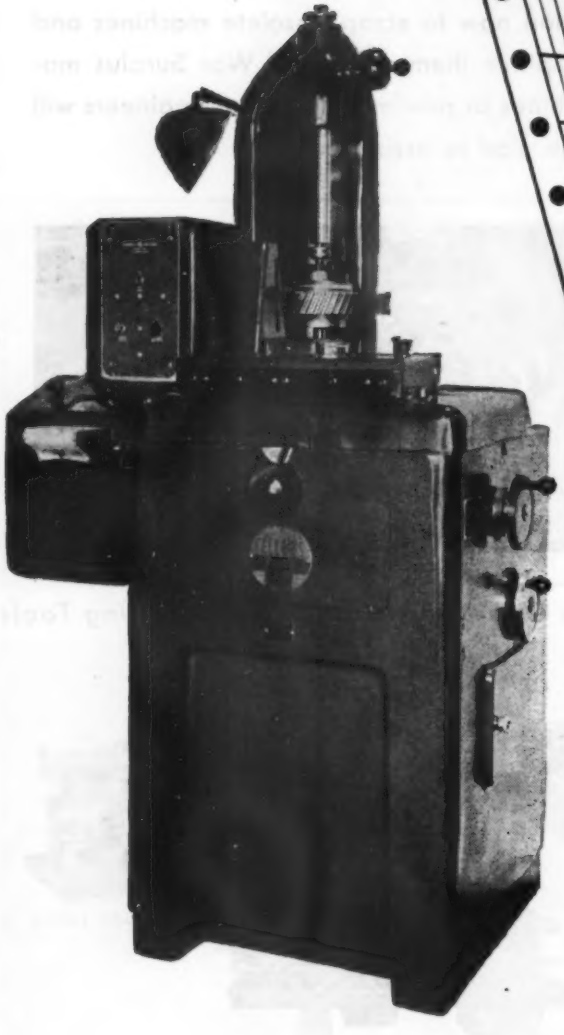
SPRINGFIELD, VERMONT, U. S. A.

Manufacturer of: Universal Turret Lathes • Fay Automatic Lathes • Automatic Double-End Milling and Centering Machines • Automatic Thread Grinders • Optical Comparators • Automatic Opening Threading Dies and Chasers.



TOOTH PROFILES CHARTED IN A



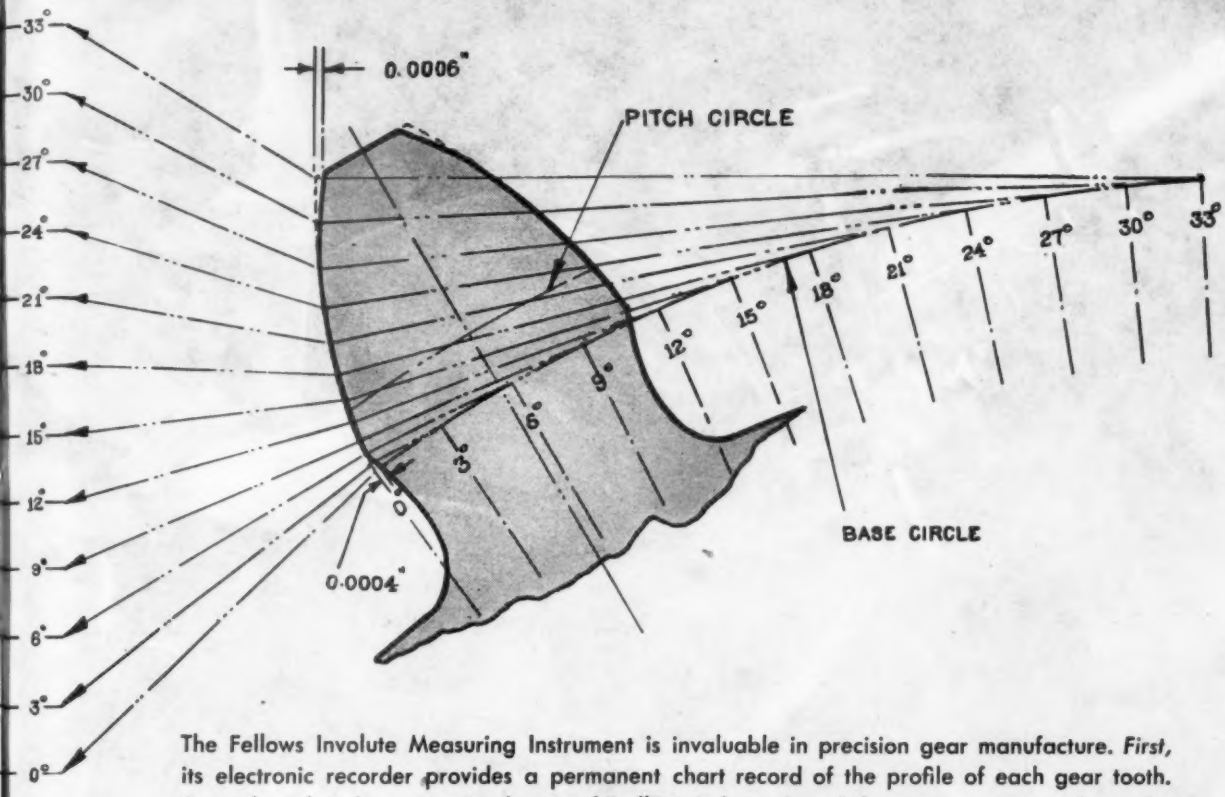


★ **Fellows Involute Measuring Instruments are built in two sizes, with 12 and 24 inches maximum capacity. Both instruments are adaptable to external and internal gears, with either spur or helical teeth. They eliminate the use of "Base Rolls", "Sine Bars", extra parts and calculations. Each instrument can be set for any gear within its capacity range simply by using standard gage blocks.**

THE FELLOWS METHOD . . . MACHINES AND TOOLS FOR AL

AS complete detail

AS AN ENLARGED SCALE DRAWING



The Fellows Involute Measuring Instrument is invaluable in precision gear manufacture. *First,* its electronic recorder provides a permanent chart record of the profile of each gear tooth. *Second,* each 3 degrees or ½ degree of "roll" is indicated, and the exact amount and *angular location* of every departure from a "true" involute is recorded.

You can detect a high fillet immediately. You can check the planned amount of under-cut and measure its angular distance outside the base circle. Similarly you can know the angular location and amount of tip relief which has been provided.

In fact, the Fellows Involute Measuring Chart creates, *from the actual gear,* a large scale record for detailed comparison with your basic large scale tooth pofile drawing.

Fellows Involute Measuring Instruments operate on a basic principle, and provide an accurate and dependable means for checking tooth profiles. Write for descriptive literature: The Fellows Gear Shaper Company, Springfield, Vermont—or 616 Fisher Bldg., Detroit 2, Michigan.

Fellows

FOR ALL OPERATIONS FROM BLANK TO FINISHED GEAR

CINCINNATI *No. 2 Centerless Grinding Machine. Catalog G-456-2 contains complete specifications. A brief description of all* CINCINNATI *Grinders may be found in Sweet's Catalog File for Mechanical Industries.*

The CINCINNATI *Centerless illustrated above is truly a Veteran of Production Wars. It has been in continuous operation since 1937 with no down time charged against the grinding wheel spindle bearings, thanks to FILMATIC.*

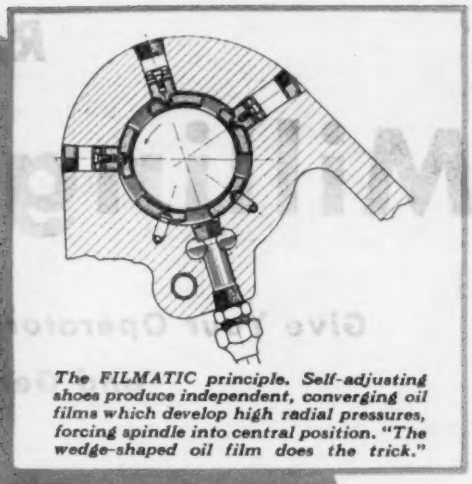
It's the lucky seventh
BUY AN EXTRA BOND!

CINCINNATI G

CENTER TYPE GRINDING MACHINES

FILMATIC

VETERAN OF PRODUCTION WARS

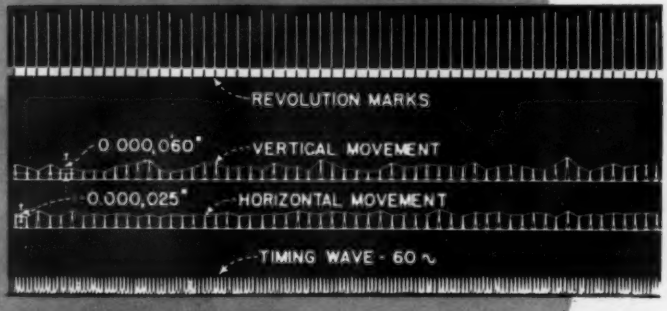


The FILMATIC principle. Self-adjusting shoes produce independent, converging oil films which develop high radial pressures, forcing spindle into central position. "The wedge-shaped oil film does the trick."

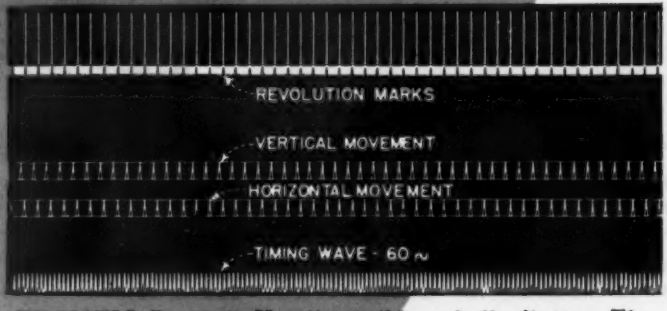
CINCINNATI Grinding Machines built several years ago are still producing at a rate equal to or greater than the original estimate, with no down time or expense due to grinding wheel spindle bearing failure. One major reason for this exceptional performance is FILMATIC Spindle Bearings. Exclusive in CINCINNATI Grinding Machines, they give you these important advantages:

1) No seizure. 2) No breakdown. 3) Eliminates spindle flutter under all operating conditions. 4) No adjusting when changing from roughing to finishing cuts. 5) Greater accuracy over longer periods of time. 6) Less wheel truing. 7) Metal removal increased as much as 30% over machines with conventional bearings.

And while FILMATIC Bearings are only one feature, they are reason enough for you to choose CINCINNATI Grinders for your centertype or centerless work. Write for booklet G-446 containing complete details about this unusual spindle bearing.



Old-style bearing. Tips of wave peaks indicate the spindle position once each revolution. The irregularity in position of the wave tips indicate a slight fluttering of the spindle axis.



FILMATIC Bearing. No discernible spindle flutter. The even alignment of the wave tips in this oscillogram indicates a true running spindle.

CINCINNATI

GRINDERS INCORPORATED

CINCINNATI 9, OHIO, U. S. A.

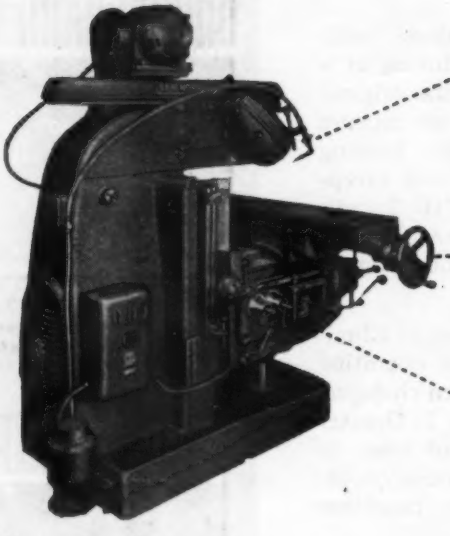
CENTERLESS GRINDING MACHINES • CENTERLESS LAPPING MACHINES

Van Norman

RAM-TYPE

Milling Machines

Give Your Operators Every Advantage in Tool Room and General Purpose Milling



The new Van Norman Ram-Type milling machines will not only do your present war work for you but will also *fit into your production scheme when you reconvert.*

Whether you need one or a dozen, each of these versatile millers gives you the working capacity of three machines. The adjustable cutterhead enables your operator to do vertical, horizontal or angular milling. This means that work re-setups are minimized since most jobs can be carried through completion in the original setup.

If most of your work is general purpose milling, then each day brings various types of milling work. One period mostly horizontal, another vertical, etc. This is when the Van Norman millers prove their worth because the adjustable cutterhead permits you to meet the fluctuating milling needs. It enables you to keep them operating continuously, saving you money by eliminating idle machine time so often encountered with single purpose machines.

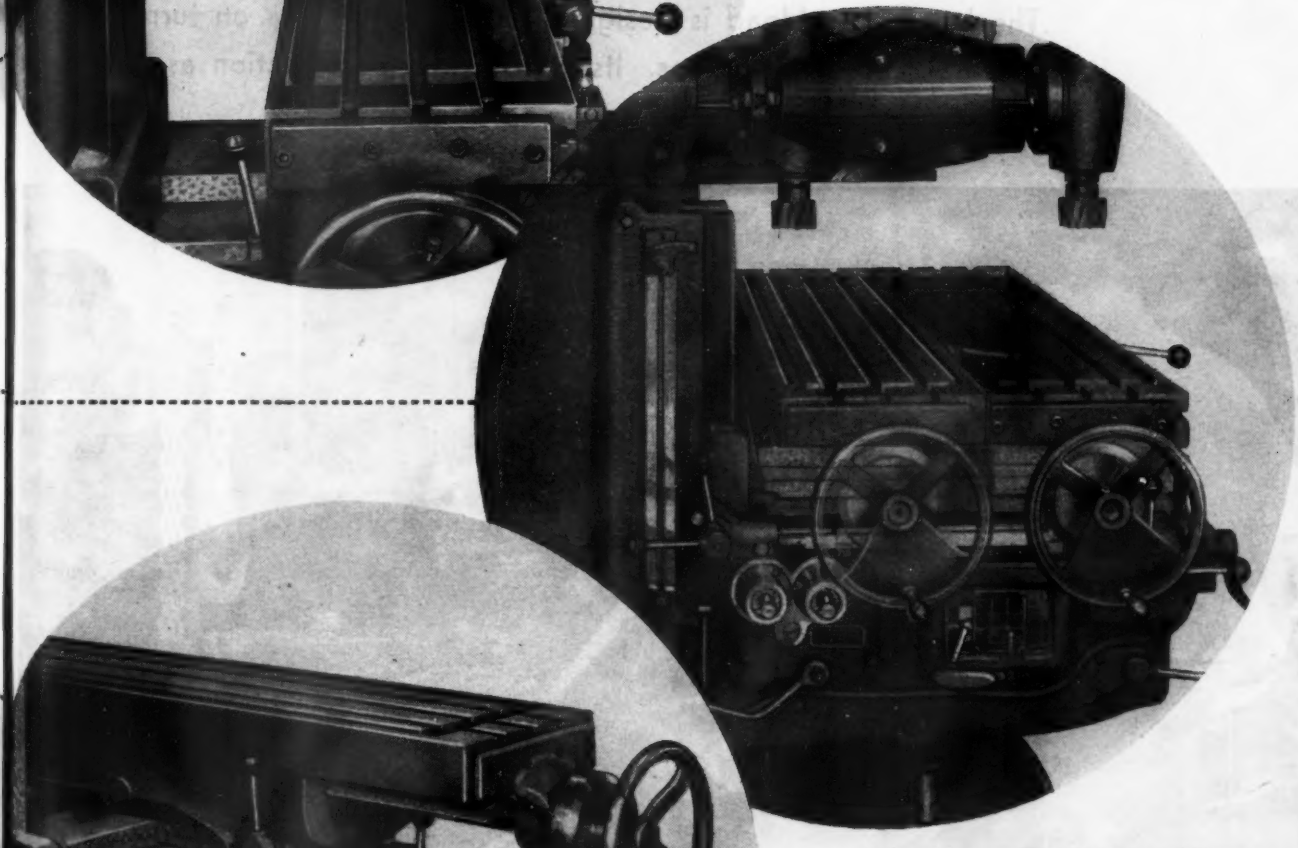
In addition, such advantages as front and rear control of both manual and power feeds, directional control of all power feeds, single lever feed selector, sturdy column, base, table and knee assembly assure simplicity of operation, accuracy, and reduce rejects. Van Norman Ram-Type millers are available with plain or swivelling tables. Write for information.

VAN NORMAN COMPANY

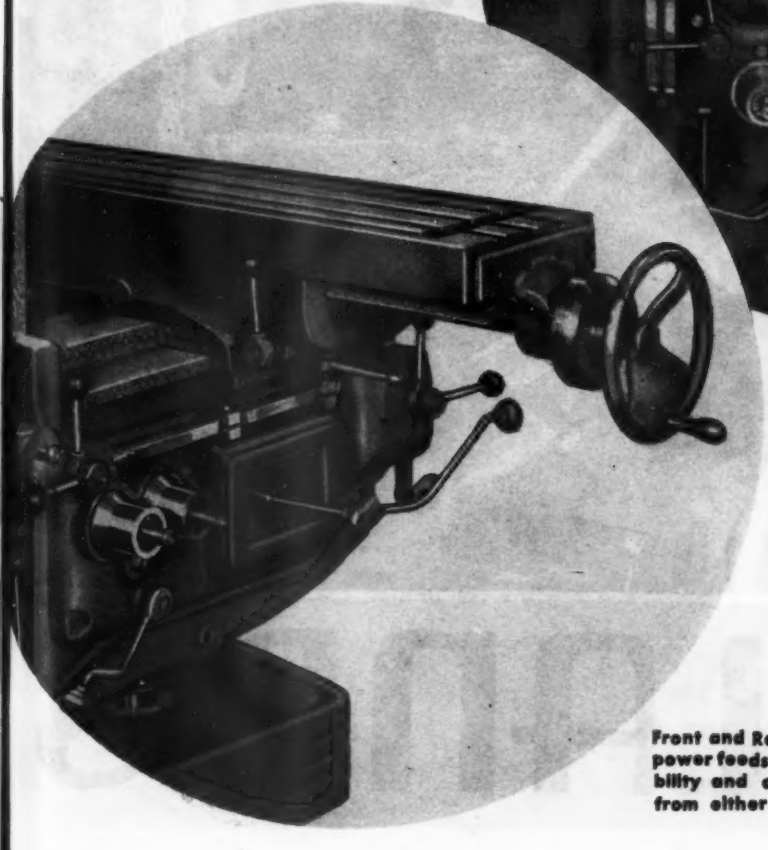
Springfield 7, Massachusetts

"It pays to Van Normanize"

Adjustable cutterhead permits vertical... horizontal . . . or angular milling all on one machine—gives you the work range of several types of millers . . . greatly reduces work reset-ups.



Adjustable cutterhead and movable ram, in combination with the saddle cross feed, provides maximum milling capacity and versatility.

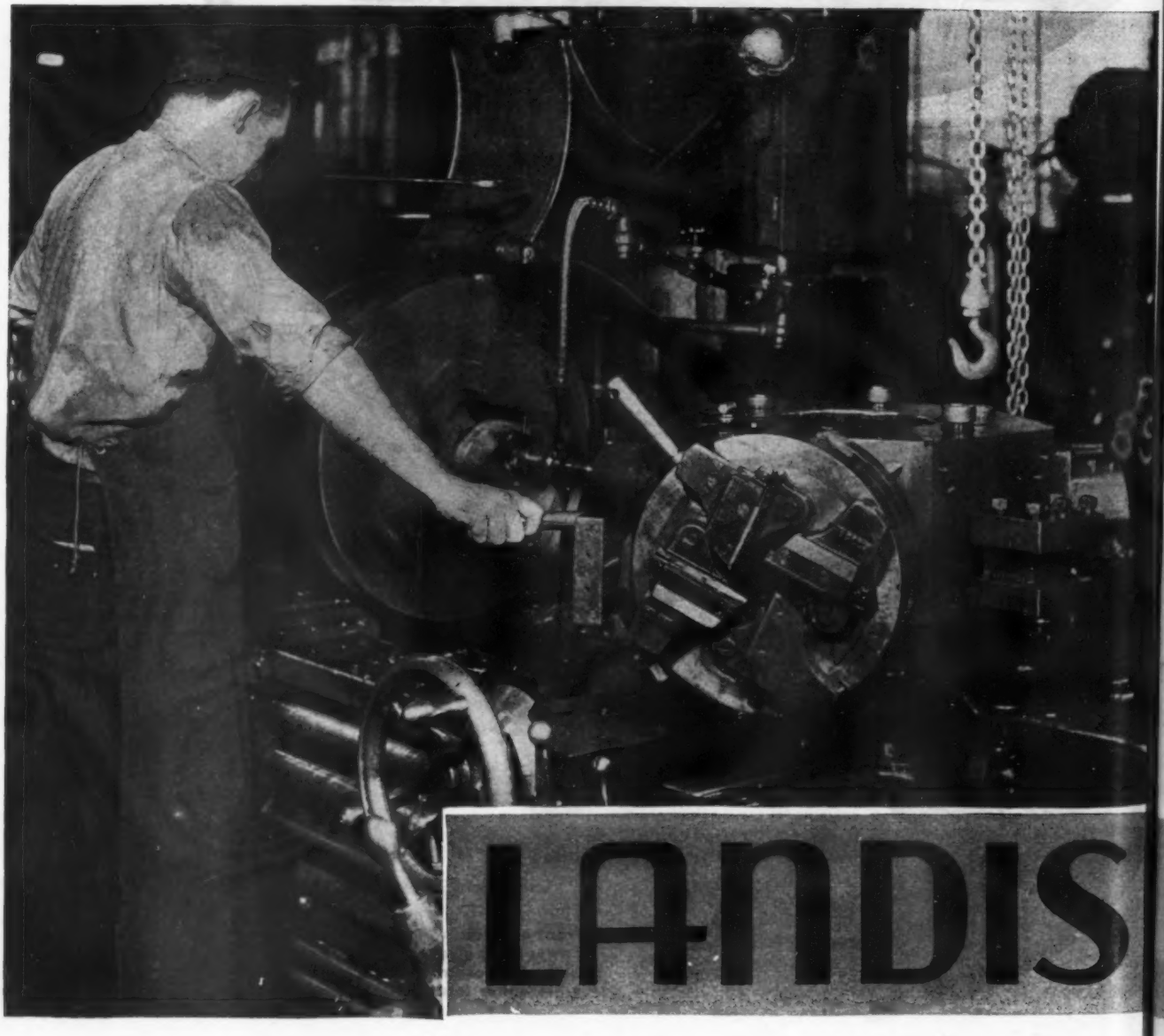


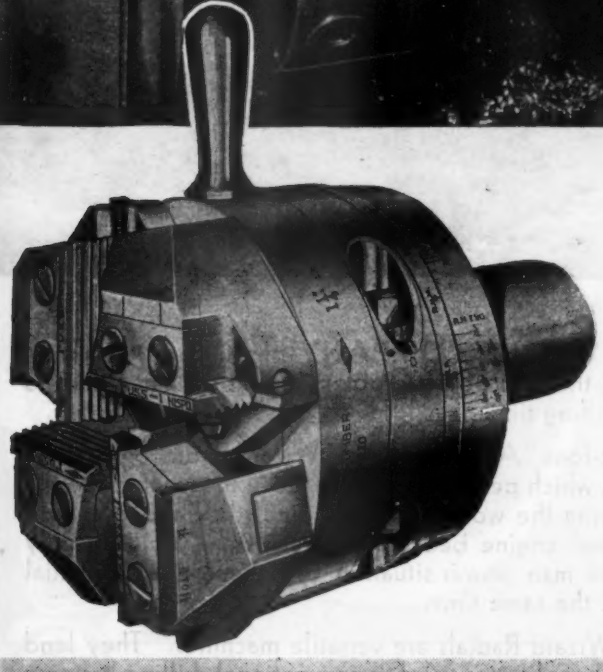
Front and Rear control of both hand and power feeds gives operator complete visibility and control of milling operations from either location.

For Turret Lathe and Hand Screw Machine Operations - the

LANDMATIC HEAT TREATED DIE HEADS ARE UNIVERSALLY USED

The Landmatic Head is designed especially for use on turret lathes and hand screw machines. Its sturdy rigid construction assures high operating efficiency and fine thread accuracy.



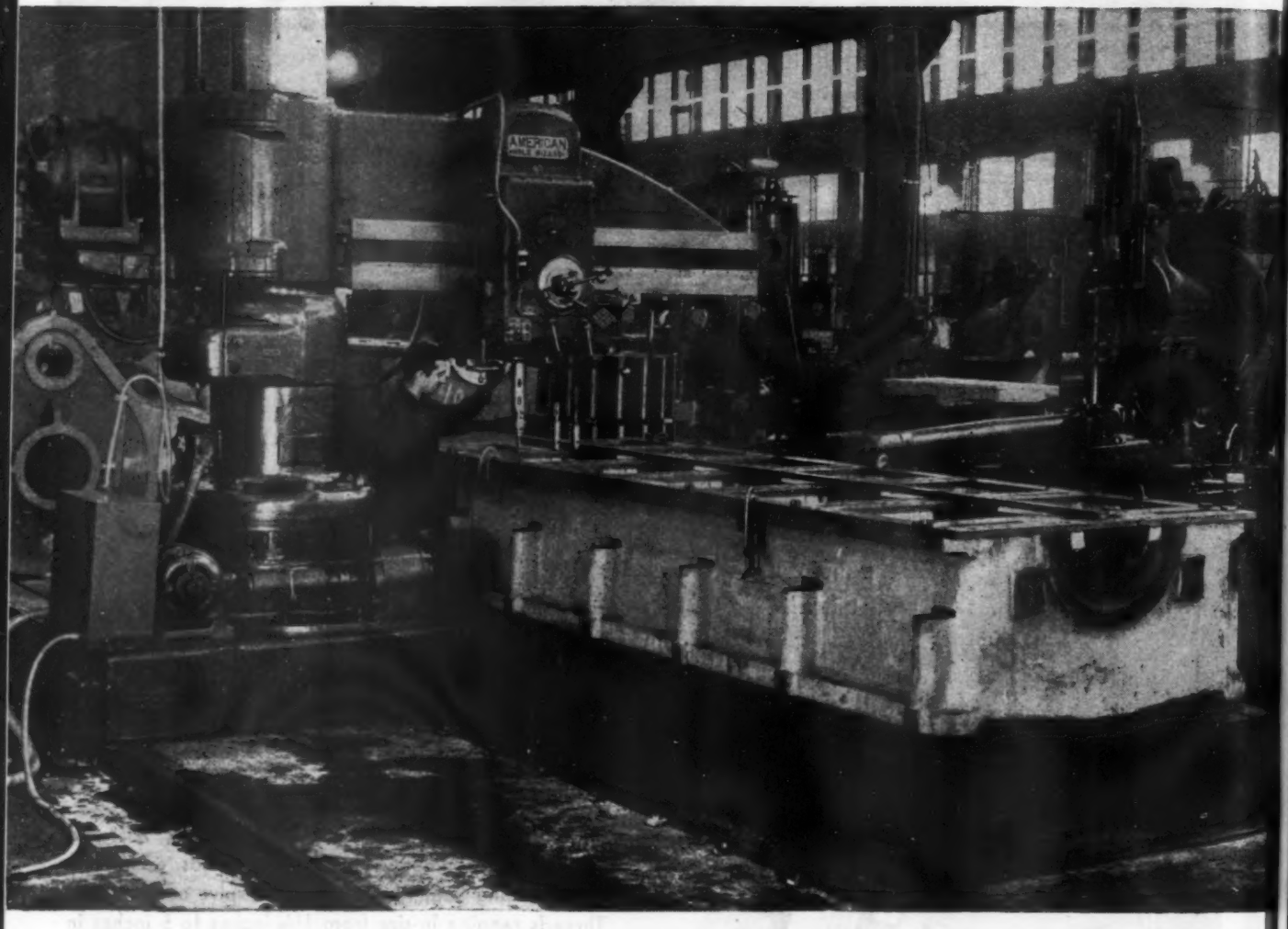


An eastern manufacturer of Gas, Steam, Air and Water Valves employs Landmatic Heads exclusively for threading Seat Rings and other valve components. Threads ranging in size from 1½ inches to 5 inches in diameter are cut with Landmatic Heat Treated Die Heads with an average saving of 30% of the cost of methods previously used. In the words of the manufacturer, "Figures definitely prove that Landmatic Heads are doing a BETTER job for us." Perhaps they may likewise do a better job on YOUR Turret Lathe Threading Operations.

Write for Bulletin F-90

MACHINE CO. WAYNESBORO PENNA. U.S.A.

FULTON found a way...



FULTON IRON WORKS COMPANY of St. Louis, Missouri, found a way to beat the man power problem and at the same time to save over 40% in drilling time.

By mounting their six-foot "American" Hole Wizard Radial on a power driven, mobile truck, which permitted them to move the machine to the work instead of moving the work to the machine, they reduced their drilling time on diesel engine bed plates over 40%. This not only materially helped the man power situation but effected a substantial reduction in costs at the same time.

"American" Hole Wizard Radials are versatile machines. They lend themselves to unusual applications and as conventional drilling, tapping and boring machines they are unsurpassed.

May we send you descriptive Bulletin No. 326?

THE AMERICAN TOOL WORKS CO.

Cincinnati, Ohio, U. S. A.

Lathes and Radial Drills

HOODOO SMASHERS!

America's newest and widest line of V-Belts — Allis-Chalmers' Texrope — solves problems that have hoodooed drives in almost every industry . . . see what they can do for you!

I ROUT THAT OLD BUGABOO, STATIC ELECTRICITY. I'M STATIC-RESISTING SUPER-7. MY BUILT-IN CONDUCTING ELEMENT CARRIES CHARGES TO THE MACHINE WHERE THEY'RE GROUNDED

A 1861

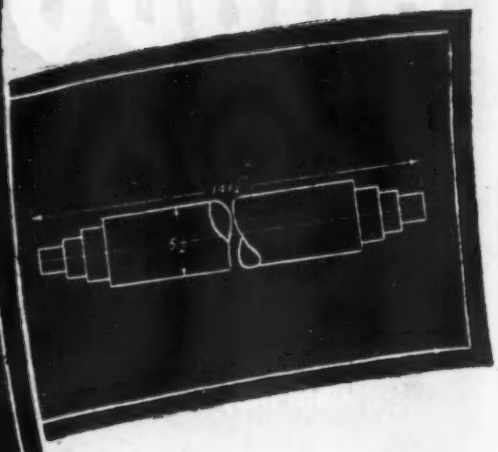
♪ *Tune in the Boston "Pops", Blue Network, every Sat. Eve.*

IT PAYS TO MAKE ALLIS-CHALMERS YOUR

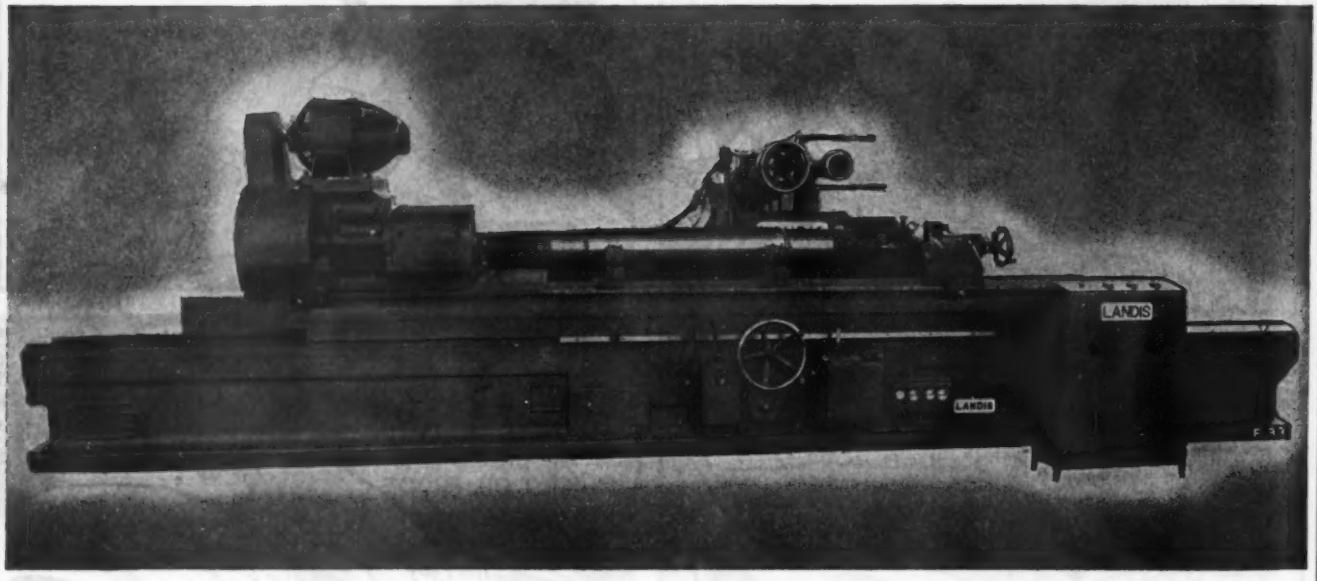
V-BELT DRIVE HEADQUARTERS

Texrope Super-7 V-Belts result from the cooperative research of two great companies—Allis-Chalmers and B. F. Goodrich—and are sold exclusively by A-C.

More Production for Grinding Large Diameters



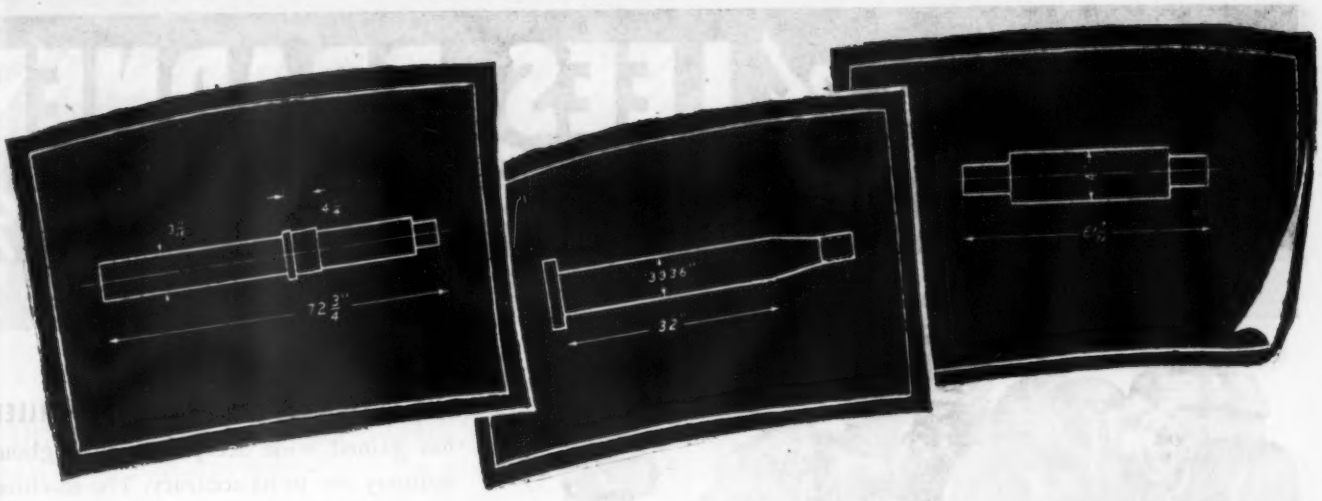
★ ROLLS ★ SHAFTS ★ PRINTING CYLINDERS



FRONT VIEW OF LANDIS TOOL 20" x 120" TYPE B PLAIN HYDRAULIC GRINDER WITH ROLL READY TO GRIND. Distance between centers of 96", 120", 144", 168" and 192" for all swings.

LANDIS TOOL *Precision Grinders*

LANDIS TOOL CO.



Fully Adjustable Controls

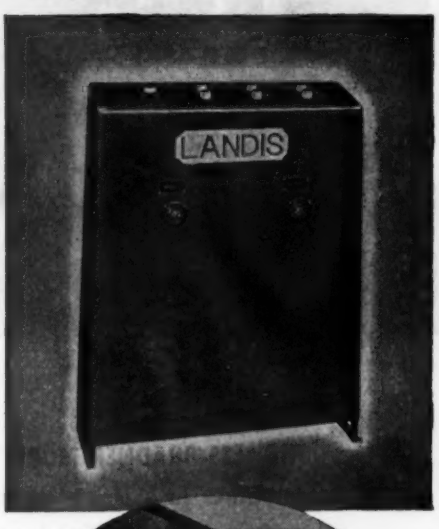
- ★ ADJUSTABLE SPEED HEADSTOCK DRIVE
- ★ HYDRAULIC WHEEL FEED
- ★ HYDRAULIC ADJUSTABLE SPEED TABLE TRAVERSE
- ★ RAPID ELECTRIC WHEEL HEAD CROSS MOVEMENT
- ★ SWIVEL TABLE

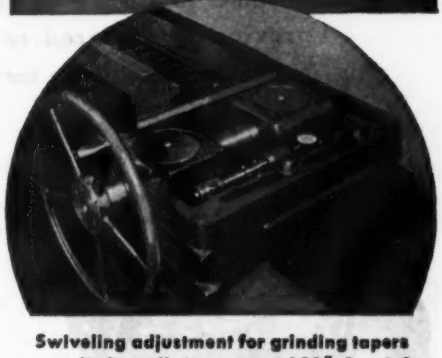
A mirror finish within limits of .0005″ on parts that weigh as much as five tons is possible with the Landis Type B Plain Hydraulic Grinder. All kinds of high capacity jobs can be handled faster and better because of the convenient adjustable control features.

The smooth stepless speed adjustment of the headstock drive and the adjustable speed table traverse permit maximum output with high accuracy. Feed and speed adjustable for maximum output make this possible. For full details on features and specifications, write for Bulletin E43.

Landis Tool engineers are available for technical help on grinding problems. For engineered grinding help, call on headquarters for grinding information. The Landis Tool Company, Waynesboro, Penna. 14

Electric control cabinet with start, stop and speed adjustment controls. Cabinet can be located at point most convenient to operator.



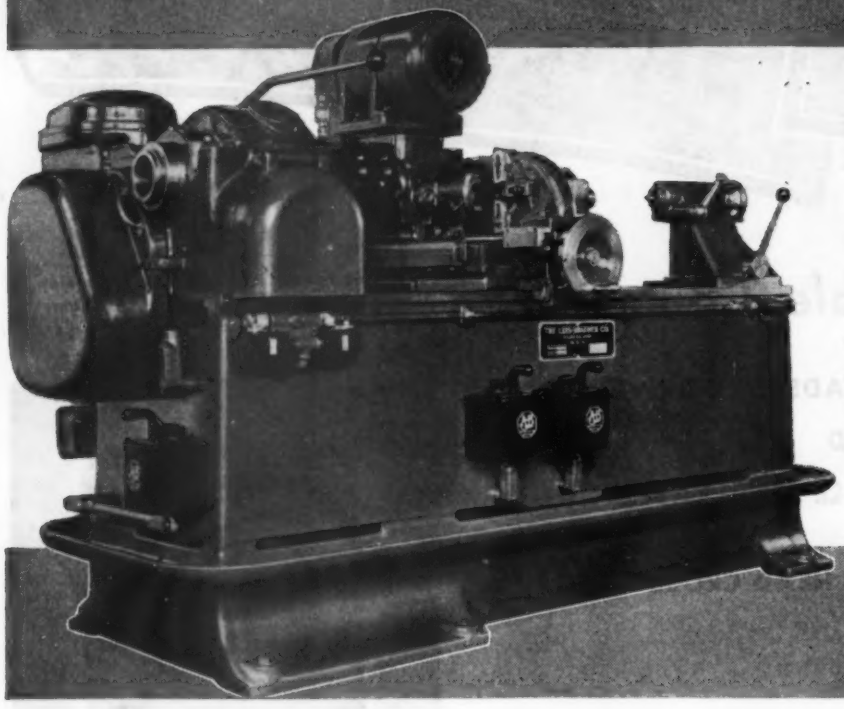


Swiveling adjustment for grinding tapers supplied on all sizes except 192″. Special accurate calibration, shown above, permits rapid, exact return to a predetermined taper.

LANDIS TOOL Company

WAYNESBORO, PA.

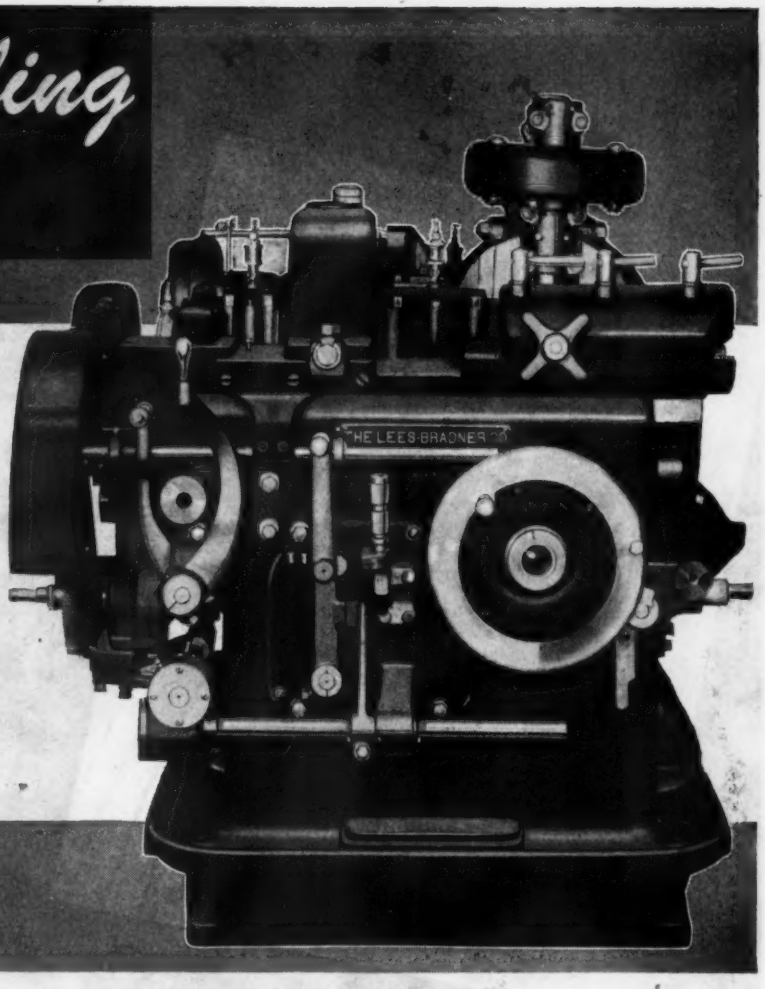
A review of LEES-BRADNER *and Gear Hobbing*



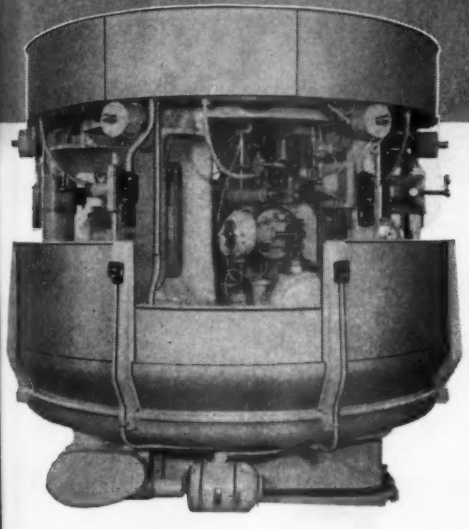
THE LEES-BRADNER LT THREAD MILLER has gained wide acceptance throughout industry due to its accuracy. The machine is suitable for either internal or external threading and can be used equally well on disc or hob type threading. It will operate on work to a maximum diameter of six inches. The machine is available in several length capacities, and has a rated capacity of 1" circular pitch.

THE LEES-BRADNER MODEL H. T. THREAD MILLER combines in a single machine processes which previously required two and often three machines. It is suitable for internal or external thread milling using either a disc or ring type cutter. Due to its inherent ruggedness, feeds and speeds far in excess of previous practice are possible. It is available in several lengths, diameter capacity to 12" and handles work up to 2½" circular pitch.

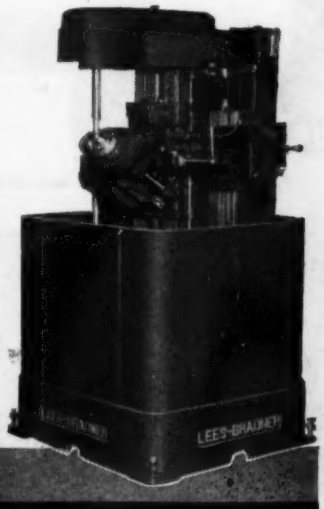
Thread Milling Machines



THE 5-AC UNIVERSAL GEAR HOBBER was designed and developed for the plant requiring the utmost in flexibility. It will generate spur gears, helical gears of any helix angle, worms, worm wheels, splines, serrations, sprockets and cam shaft gears, etc. Thus it is capable of a wide range of gear work requiring high precision tolerances.



THE ROTARY GEAR HOBBING MACHINE represents the ultimate in high speed, accurate production of a wide range of gears, splines and similar operations. It is built in four, six or eight spindles and each spindle may be arranged for the same job or for different jobs, climb or conventional cut. Lees-Bradner pioneered this construction and it has proved highly successful in the mass production of precision gears and spline work.

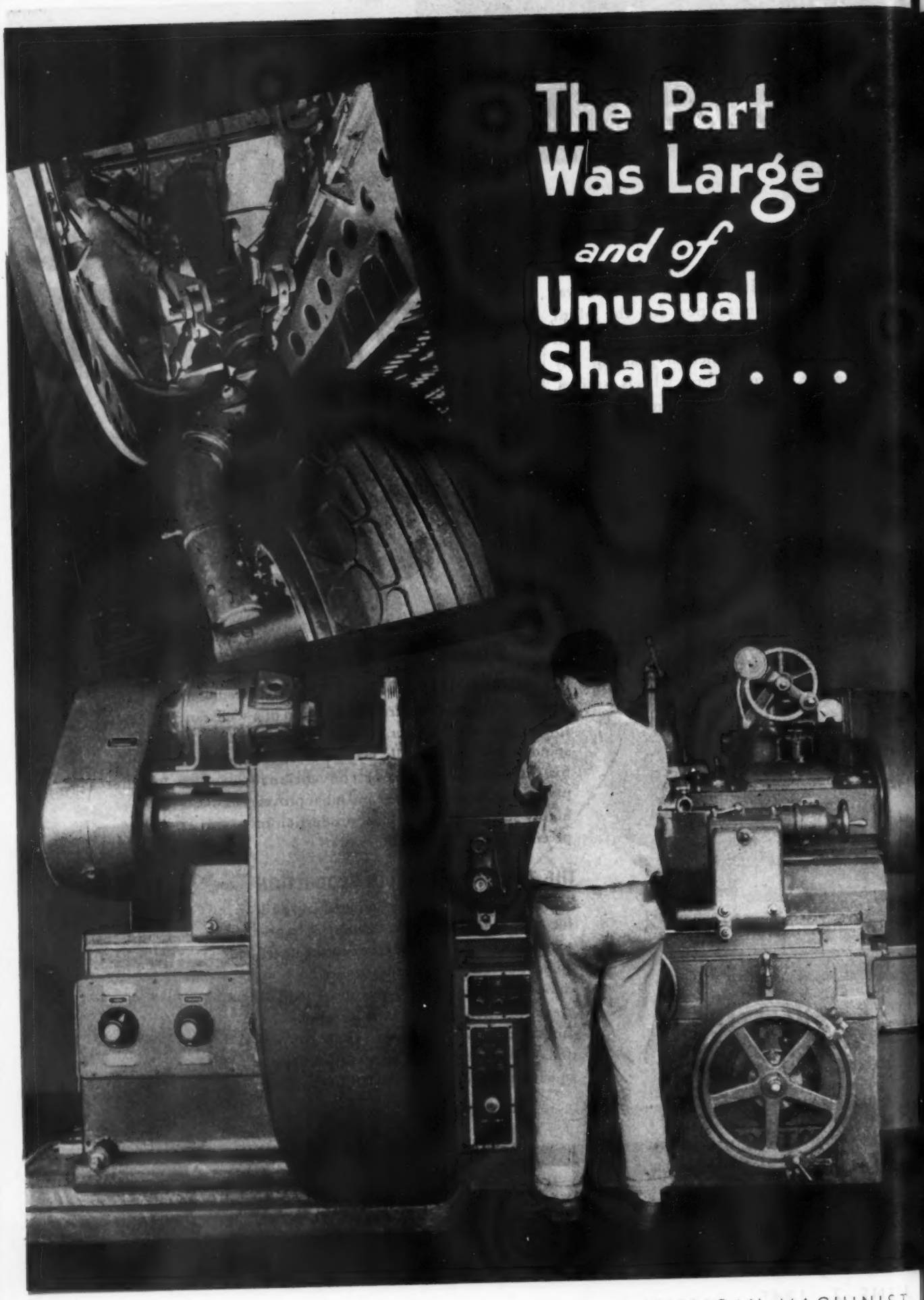


THE 7-A SINGLE SPINDLE PRODUCTION HOBBING MACHINE was designed and built for continuous heavy production. It represents over thirty years of effort in the development of finer more accurate gear hobbing equipment. Suitable for spur gears, helical gears, sprockets, spline shafts serrations and cam shaft gears—adaptable to either conventional or climb cutting and available with an automatic hob in-out mechanism.

BULLETINS
available on all machines illustrated. Write for them.

The LEES-BRADNER Company

CLEVELAND, OHIO, U.S.A.


The Part
Was Large
and of
Unusual
Shape . . .

NORTON Engineered a Machine to Grind It

THE Cleveland Pneumatic Tool Company, Aircraft Division, Cleveland, Ohio, was requested to produce "Aerols" (landing gear units) for aeroplane landing gears at a greatly increased production rate.

Norton engineers, well acquainted with the problems of grinding large, difficult parts, designed a special machine to grind these struts of peculiar shape and construction.

Outstanding features of this machine include:

Large Swing Gap (80 inches), adjustable for width and arranged on a swivel table to permit grinding of tapers.

Traveling wheel head operated by a precision rotating screw driven by a reversing motor.

All controls located convenient to the operator.

Unusual grinding problems are always welcome. Norton engineers are ready to adapt Norton Grinders to your needs or to design special machines.

NORTON COMPANY, WORCESTER 6, MASS.

M-501

NORTON GRINDERS and Lappers

Prewar planning has improved

As part of our continuing program to improve Monarch turning machines, important new ideas were on our drafting boards and in miniature models when the war stopped their final development.

We're going ahead with these now—and utilizing to the utmost the scientific and technological advances resulting from war production. We are drawing on our own experience in producing high-precision war equipment, such as elevating and training mechanisms for naval guns and the intricate Rotol gear unit for aircraft engines.

Prewar planning plus war-gained experience will thus provide the finest Monarch turning machines we have ever offered to American industry. Many of these machines, on priority orders, are already proving their ability to produce more parts at lower cost and with higher precision than any we have ever built.

We suggest that you consult with your nearest Monarch representative on your present or postwar turning problems.

THE MONARCH MACHINE TOOL COMPANY • SIDNEY, OHIO

DIRECT FACTORY BRANCHES

CHICAGO 6, ILLINOIS
622 W. Washington Blvd.
Phone: Randolph 4295

CLEVELAND 6, OHIO
Room 209 Upper Carnegie Bldg.
10465 Carnegie Avenue
Phone: Garfield 2590

DETROIT 2, MICHIGAN
801 Fisher Building
Phone: Trinity 1-0426

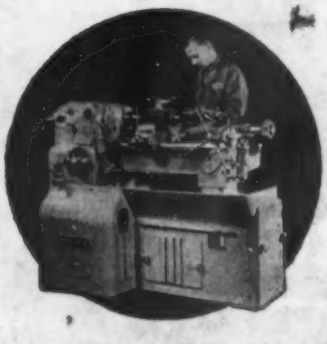
INDIANAPOLIS, INDIANA
Maco Building
38 and College Avenue
Phone: Wabash 2650

NEWARK 2, NEW JERSEY
635 Industrial Office Bldg.
Phone: Mitchell 2-1770

PITTSBURGH 22, PENNSYLVANIA
512 Empire Building
Liberty Ave. and Stanwix St.
Phone: Atlantic 6428

Representatives in Principal Cities

THESE NEW MONARCH MACHINES WILL LOWER YOUR TURNING COSTS

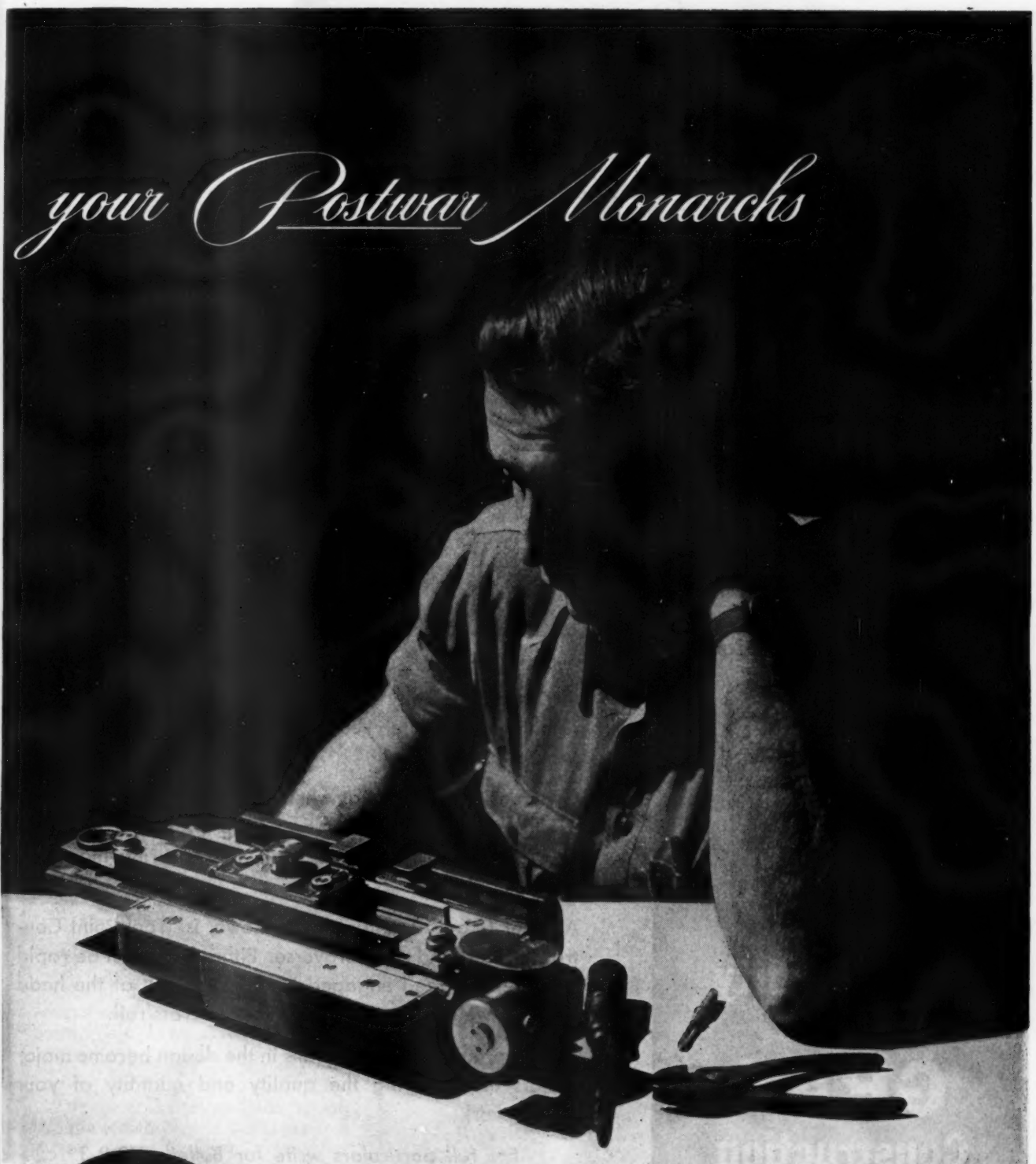


One of 3 types of Monarch's new Hi-Speed Precision Manufacturing Lathes.

New Monarch Shapemaster with Electric Controls.

New Monarch 10" x 20" Sensitive Precision Toolmaker's Lathe.

your Postwar Monarchs

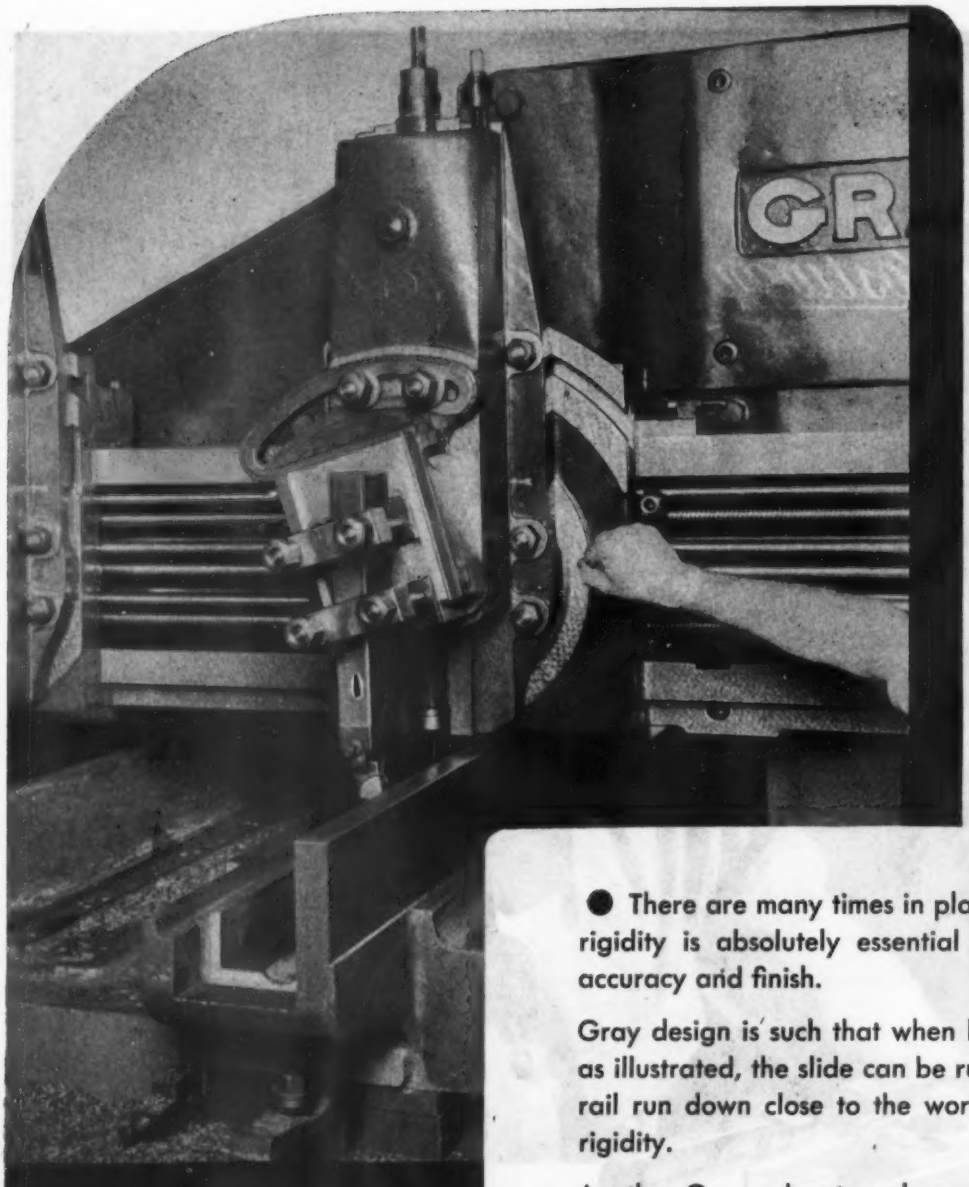


New Monarch Fully-Automatic Magnamatic Lathe.

ENGINEERS AND DESIGNERS WANTED

Monarch maintains designing and engineering offices in Dayton and Sidney, Ohio, for which we need alert, experienced, creative board men. WMC compliance required. Address replies to Sidney, Ohio.

Monarch Saves Time



Tool Rigidity features GRAY Construction

● There are many times in planing operations when tool rigidity is absolutely essential for maintaining required accuracy and finish.

Gray design is such that when long reach tools are used, as illustrated, the slide can be run up on the harp and the rail run down close to the work, thus insuring maximum rigidity.

Another Gray advantage here shown, is "Tool Point Control" of feed and rapid traverse. Either head can be rapid traversed, or feed engaged in any direction at the head itself, as well as from both ends of the cross rail.

These apparently minor details in the design become major factors in improving the quality and quantity of your planer work.

For full particulars write for Bulletin 40-R-3.

THE G. A. GRAY COMPANY

3610 WOODBURN AVENUE • • • CINCINNATI 7, OHIO, U. S. A.

THE GRAY LINE — Double Housing and Openside Planers, Switch Planers, Die Block Planers, Double-Housing and Openside Milling Planers, Planer Type Milling Machines, Horizontal Boring Machines.

The CONE AUTOMATIC MACHINE COMPANY sees many GOOD THINGS AHEAD

It is reported that . . . . . .

A new aluminum alloy, R-303, is claimed to be non-corrosive and to have twice the compressive strength of structural steel. *Reynolds Metals Co.*

get ready with CONE for tomorrow

A method has been announced for transmitting television programs over ordinary telephone lines, instead of coaxial cables or air relays, and for the recording of television in a manner comparable to the recording of radio. *Packard Mfg. Co.*

get ready with CONE for tomorrow

The fuel being used in the B-29's over Japan is said to have an octane rating well over 130. *Aero Digest.*

get ready with CONE for tomorrow

This year's models of one make of highway bus have rubber springs. *Twin Coach.*

get ready with CONE for tomorrow

A newly installed turbine generator, in a city power station, has twice the capacity of the 14 previously installed units combined. *Fisk Station, Chicago.*

get ready with CONE for tomorrow

One of our new aircraft engines weighs only 0.97 pounds per horse power. *Wright Cyclone 9.*

get ready with CONE for tomorrow

The first American-built steam turbine locomotive is being given a service test. *Baldwin Locomotive Works, Penna. R. R.*

get ready with CONE for tomorrow

Army aircraft are being "jacked up" when on soft ground by inflating large rubber pillows placed under the wings. *Science News Letter.*

get ready with CONE for tomorrow

A manufacturer of aluminum utensils is planning to make aluminum kitchen furniture. *Aluminum Cooking Utensils Company.*

White or light colored vitreous enamels can now be applied directly to steel surfaces. *Inland Steel Company.*

get ready with CONE for tomorrow

A company has been established to process three-dimensional photographs (vectographs) in quantity for civilians. *Three Dimension Company.*

get ready with CONE for tomorrow

A new processed wood called "Staypak" has been developed that is claimed to be twice as tough as "Compreg". *U. S. Forest Products Lab., Madison, Wisconsin.*

get ready with CONE for tomorrow

In one city a system of radiotelephone communications between a central station and public or private vehicles is expected to be in operation by next fall. *Pittsburgh.*

An airport bus, designed to connect small towns with main airlines, has a ticket office, flight control tower, freight space, lunch counter, two-way radio, telephone and washroom, as well as seating space for passengers. *Parks Air Transport East St. Louis.*

get ready with CONE for tomorrow

Reports say that one of our largest automobile manufacturers is planning an entirely new 5-cylinder car to sell at about 20% below the lowest prewar level. *Ford.*

get ready with CONE for tomorrow

A new process so reduces the cost of making gasoline from natural gas that a large refinery is being planned for this purpose. *M. W. Kellog, Jersey City.*

get ready with CONE for tomorrow

30 to 50 ton trucks as long as 75 feet have been built and are now being put to specialized uses, such as the hauling of ore, aircraft and prefabricated houses. *Scientific American.*

SPEED
for
tomorrow's
competition
Sixteen tools on an 8-spindle Conomatic complete this part in 23 seconds — including the small hole on the end.
CONE
AUTOMATIC MACHINE CO., INC. ★ WINDSOR, VERMONT, U. S. A.

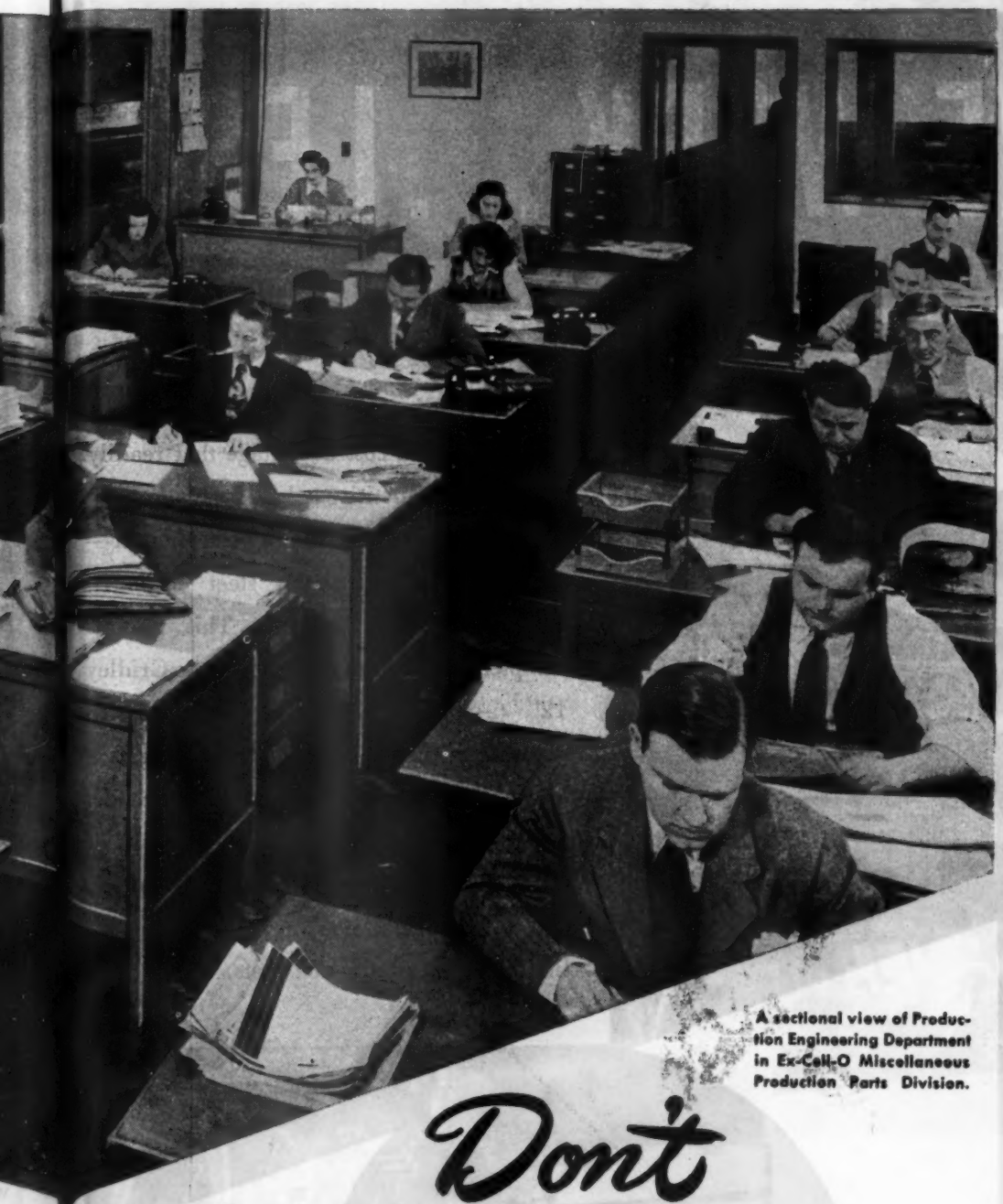
WE ARE STILL MAKING PARTS FOR WAR

But

EX-CELL-O IS READY FOR *Peace*

The same long years of engineering experience . . . the modern and complete facilities . . . the manufacturing "know how" . . . that have given Ex-Cell-O an outstanding record in production for war can help you solve the problem of mass production of accurate parts and sub-assemblies for your peacetime products. Ex-Cell-O, with machining, heat-treating, grinding and sub-assembling facilities all under one management, offers you many practical advantages. Send your print or part to Ex-Cell-O in Detroit today, or get in touch with any member of Ex-Cell-O's field engineering staff in 32 industrial centers in the United States and Canada.

EX-CELL-O CORPORATION



A sectional view of Production Engineering Department in Ex-Cell-O Miscellaneous Production Parts Division.

XLO
EX-CELL-O for PRECISION

EX-CELL-O's *facilities:*

*PRODUCTION ENGINEERING

The Ex-Cell-O organization, with skill, facilities and modern methods that have made a wartime record, can make an important contribution in the planning of quantity production of quality parts and unit assemblies for your postwar product.

HEAT TREAT

Induction Heating
Laboratory for Heat Treat Control Including Micro Examination and Photography
Atmosphere Control Continuous Hardening Furnaces
Atmosphere Control Box Hardening Furnaces
Various Types of Air-Draw Batch Type Furnaces
Gas Carburize Furnaces
Box Carburize Furnaces
Pack Anneal Furnaces
Nitriding Furnaces
Cyanide, Lead, and Neutral Salt Pot Furnaces
High Speed Steel Atmosphere Control
Vertical and Horizontal Hardening Furnaces
Continuous Air-Draw Furnaces
Sub-Zero Heat Treating Equipment

PRODUCTION MACHINES

Multiple Vertical Turret Lathes
Multiple Spindle Automatic Screw Machines
Single Spindle Automatic Screw Machines
Hand Screw Machines
Centerless Grinders
Single and Multiple Spindle Drilling Equipment
Plain O.D. Grinders
Plain I.D. Grinders
Milling Machines
Broaching Machines
Precision Thread Grinders
Precision Boring Machines
Lapping Machines
Special High Production Equipment

UNIT ASSEMBLIES

For many years Ex-Cell-O has supplied large and small manufacturers with parts and has also supplied many parts in unit assemblies after machining, heat treating and grinding.

INSPECTION

Ex-Cell-O has always maintained that quality in a product is not the result of accident; that quality is built into a product by rigid adherence to accepted quality standards . . . standards that are upheld at Ex-Cell-O by efficient inspection at every step of the machining process.

*A section of Ex-Cell-O Production Engineering Department is illustrated in this advertisement.

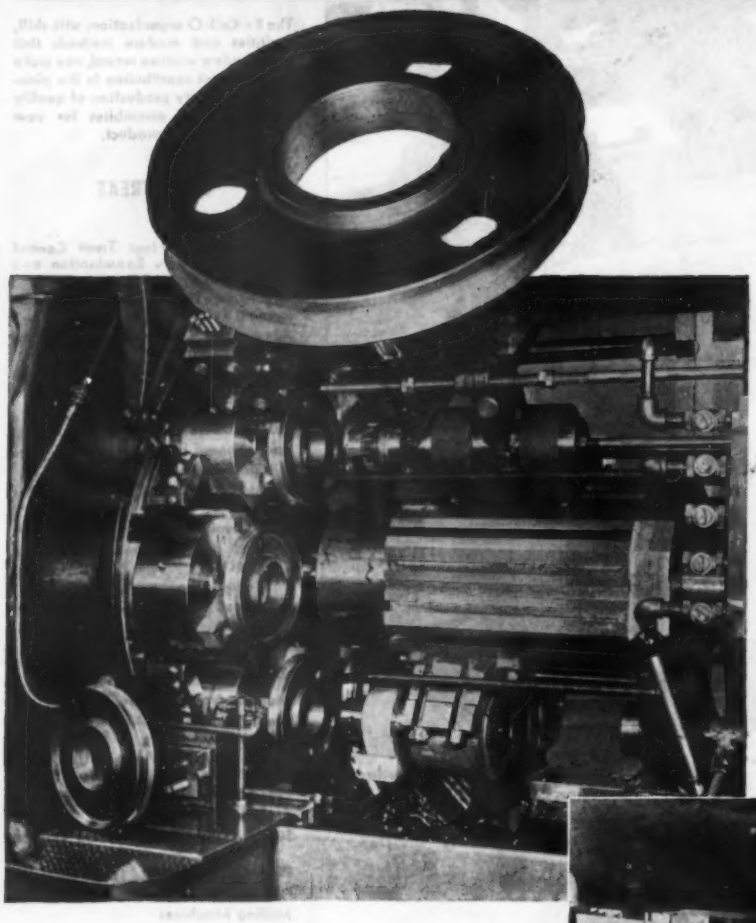
45—87

If you do not now receive Ex-Cell-O TOOL TIPS, devoted to precision and speed in production, send Ex-Cell-O your name, company, address and position.

Don't
gamble with your future product . . . plan to use XLO PARTS

N DETROIT 6, MICH.

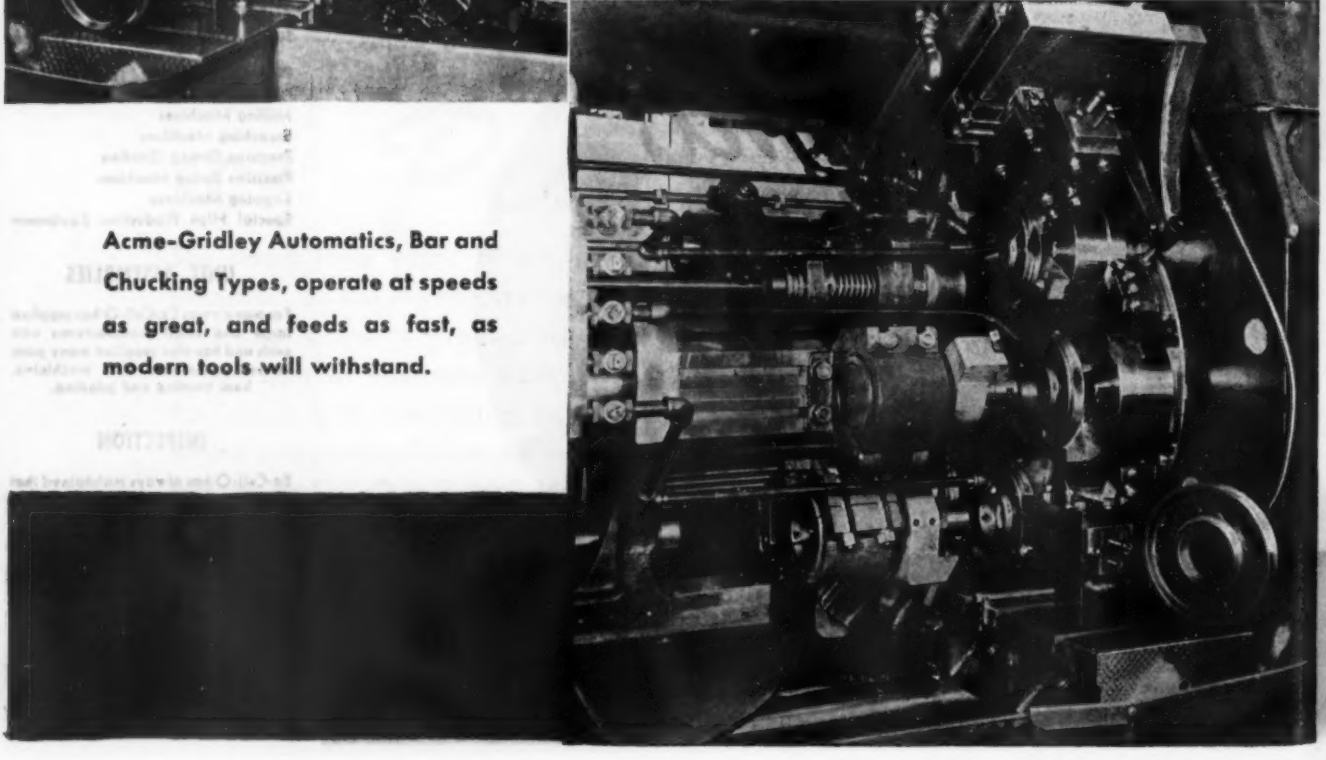
MORE WORK...LESS



Turn out an improved product in less time and you have a *cost* advantage that readily becomes a competitive *sales* advantage.

For example, take this big tractor part—made from a tough alloy steel forging—9¾″ diameter, 1⅜″ thick. This part is completely finished on an Acme-Gridley 12″ 6-Spindle Chucking Automatic. 15 separate operations—15 tools working as a team—machine time less than 35 seconds.

The manufacturer who adopts that kind of production practice, no matter what he makes from metal, need never fear competition based on production costs.



Acme-Gridley Automatics, Bar and Chucking Types, operate at speeds as great, and feeds as fast, as modern tools will withstand.

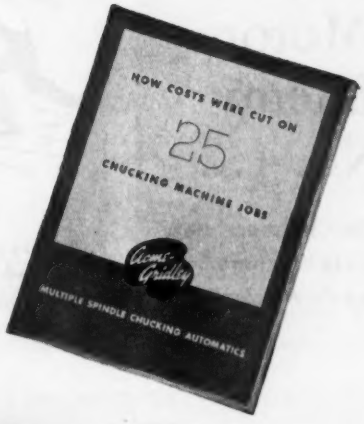
COST *On the Acme-Gridley Chucking Automatic*

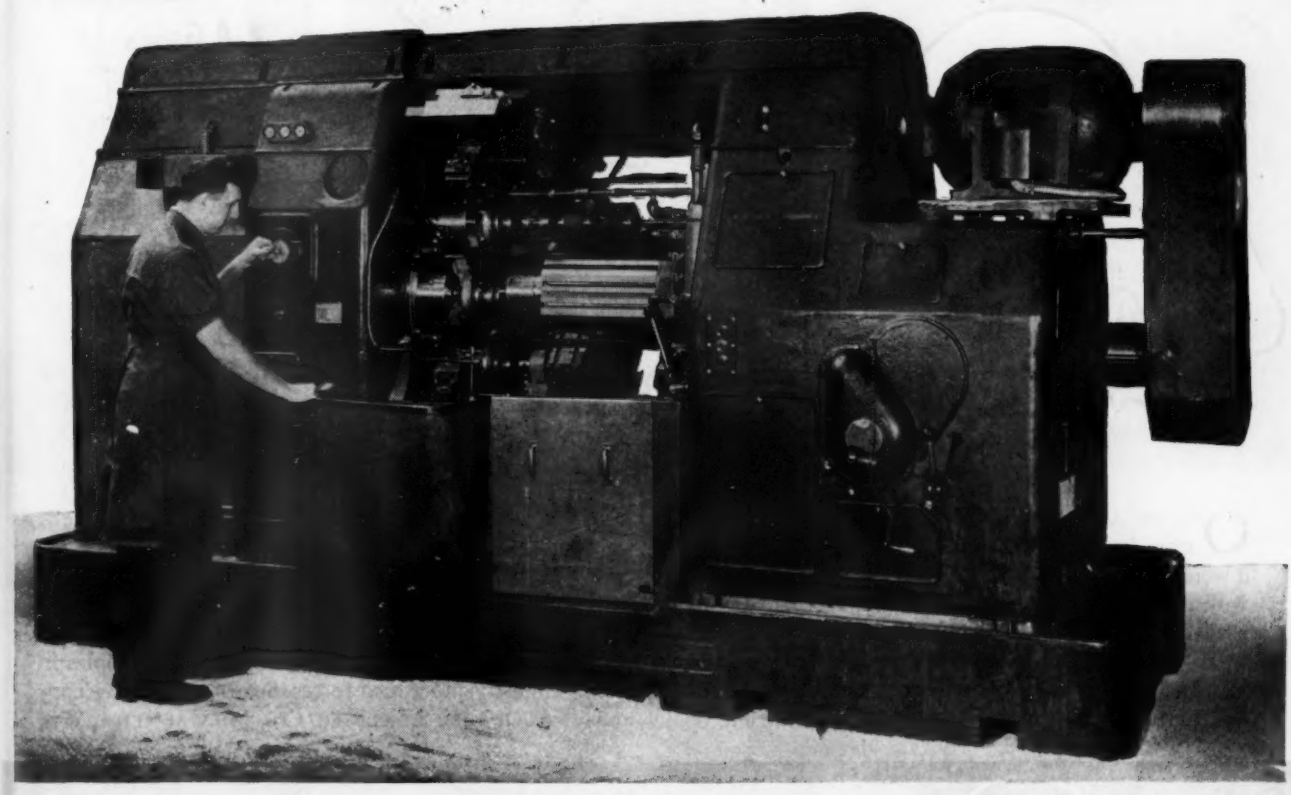
The Acme-Gridley Automatics—both Bar and Chucking Machines—that have been producing war materials are not special-purpose, one-job machines.

They are *universal*—quickly adaptable to production for peace. Often a simple retooling is all they need.

The one important thing about them that does not change is their ability to *produce more for less.*

Your production executives, and sales executives too, will be interested in this book, "How Costs Were Cut on 25 Chucking Jobs". Send for as many copies as you can use.





The NATIONAL ACME CO.

170 EAST 131st STREET • CLEVELAND 8, OHIO

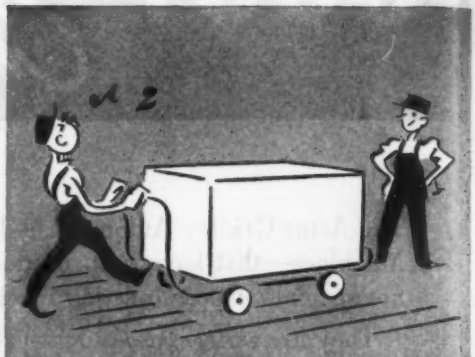
Acme-Gridley 4-6 and 8 Spindle Bar and Chucking Automatics • Single Spindle Automatics • Automatic Threading Dies and Taps • The Chronolog • Limit, Motor Starter and Control Station Switches • Solenoids Centrifuges • Contract Manufacturing

FIGHT FRICTION!

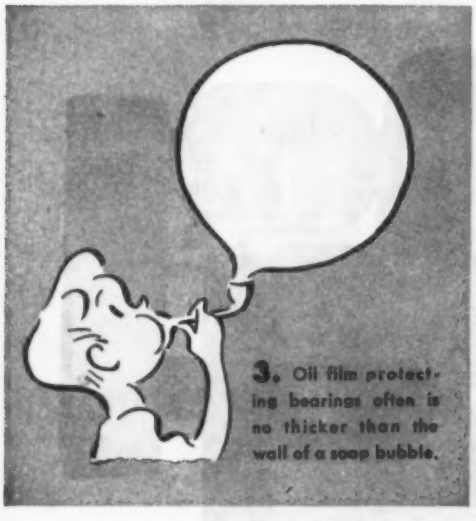
It's Electric Motor Enemy No. 4...

In Allis-Chalmers' new "Guide to Wartime Care of Electric Motors".

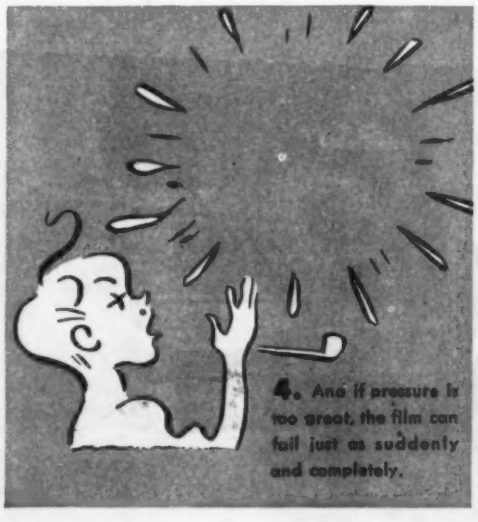
1. Like a motor without oil. Simple! Yet every day hundreds of workers overlook the importance of adequate motor lubrication.



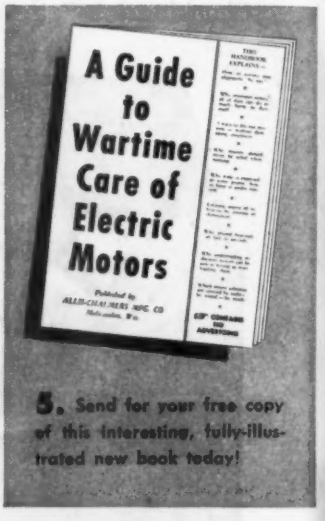
2. Like a motor with oil. Pictures like these make motor maintenance easy to put across in training new employees.



3. Oil film protecting bearings often is no thicker than the wall of a soap bubble.



4. And if pressure is too great, the film can fail just as suddenly and completely.



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510	5⅜ x 10⅜	1236	12⅛ x 36
618	6⅜ x 18⅛		

*Differs from illustration

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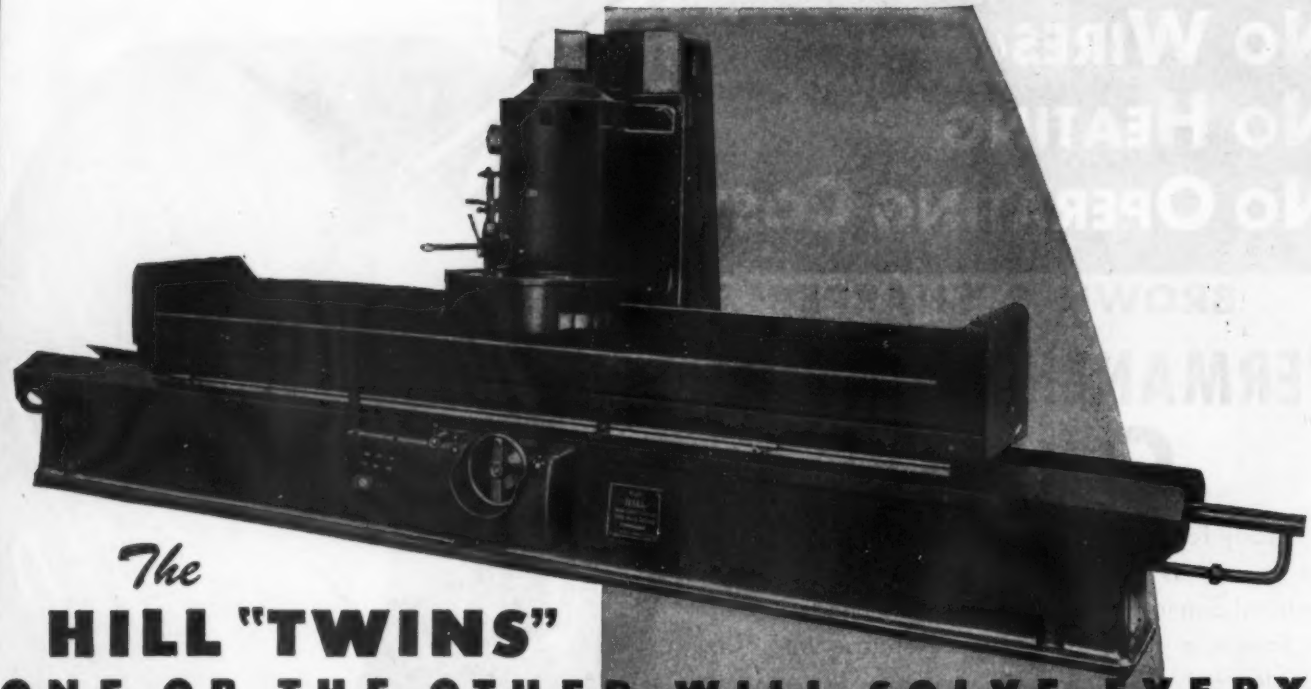

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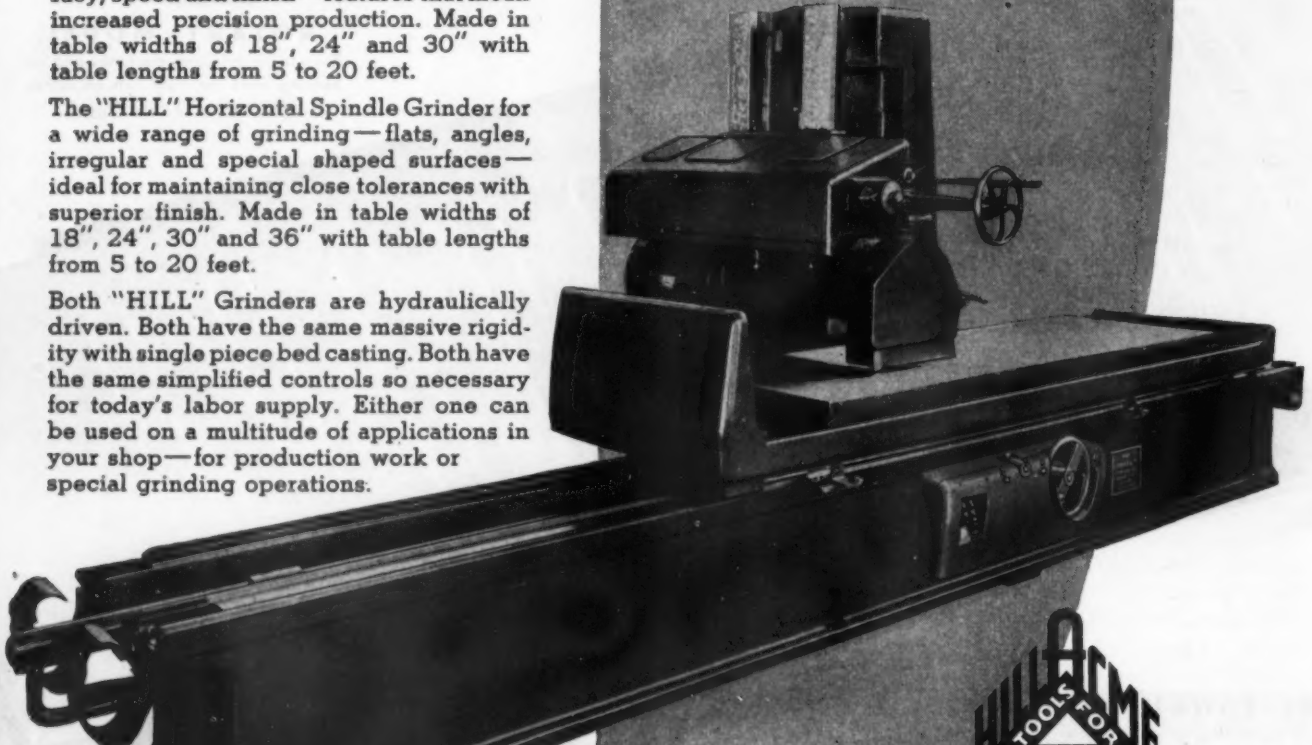

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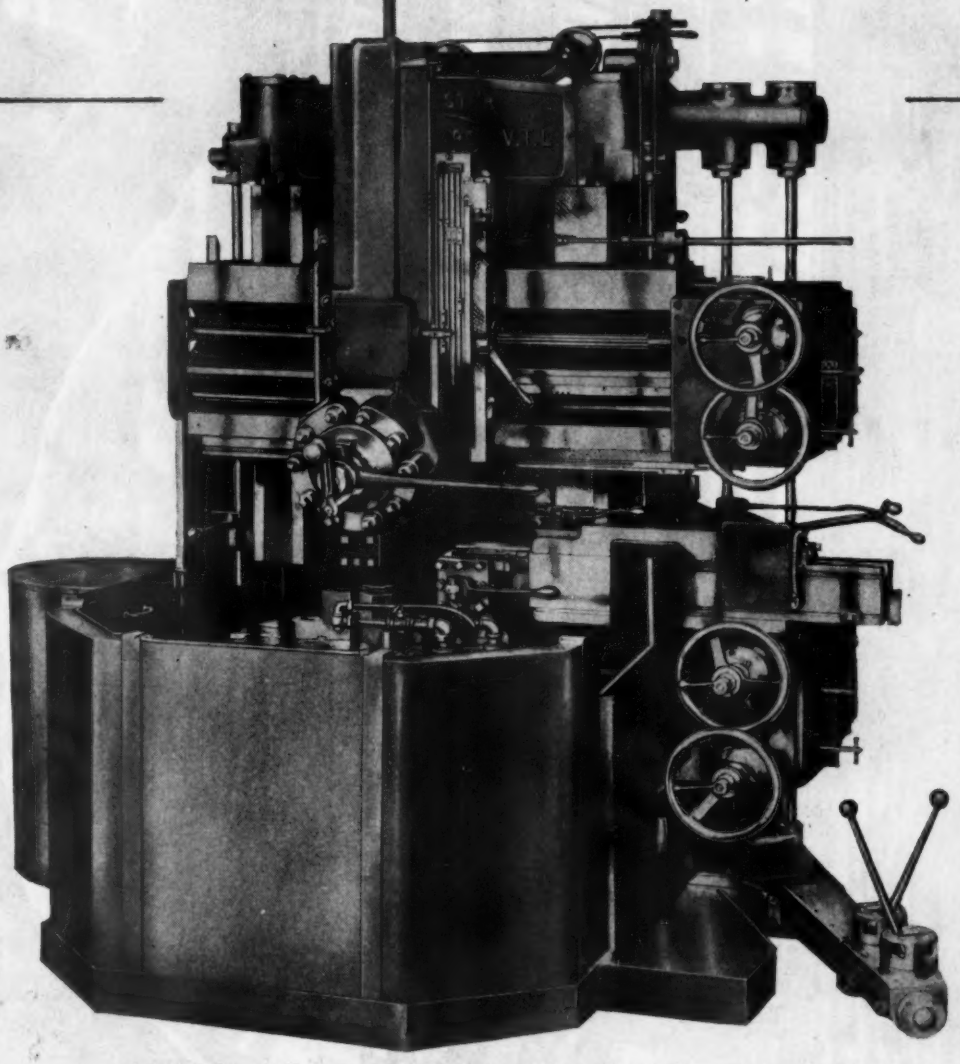

Bullard 30" and 36" Cut Master Vertical Turret Lathes with swiveling main turret head and non-swiveling side head. 16 feeds for each head in geometrical progression from .0026 to .500 per work spindle revolution. 20 table speeds. Larger machines in 42", 54", 64" and 74" sizes, with choice of six different head combinations.

Lower machining cost is a natural for every minute of operation of Bullard Cut Master Vertical Turret Lathes. That is because Bullard Cut Masters are designed and built to cut time *on* cuts and *between* cuts.

Screw feeds of main heads assure a high degree of machining accuracy.

Heavy, rigid construction plus H.P. rating and range of feeds and speeds adequate for the fastest cutting tools assure rapid machining with maintained accuracy under the heaviest cutting.

Heavy simultaneous cutting with both heads, easy chucking, conveniently located controls and quick-reading micrometer dials add to the productive ability of every operator.

Cut Master's metal-removing ability shortens machining time.

For complete description of the cost-cutting features of Bullard Cut Master Vertical Turret Lathes, write today, specifying the size that interests you. The Bullard Company, Bridgeport 2, Connecticut.

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We who are lost ask only this of you: Please, please buy another bond.

Buy it and keep it—for our sake.

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Precision tool room milling is profitable on this milling machine, designed to meet a definite need in the tool room and laboratory. The precision construction, along modern lines, combines ruggedness with extreme accuracy for ease of operation. Investment and time cost will indicate that larger milling machines are extremely expensive and awkward for many tool room and laboratory milling operations.

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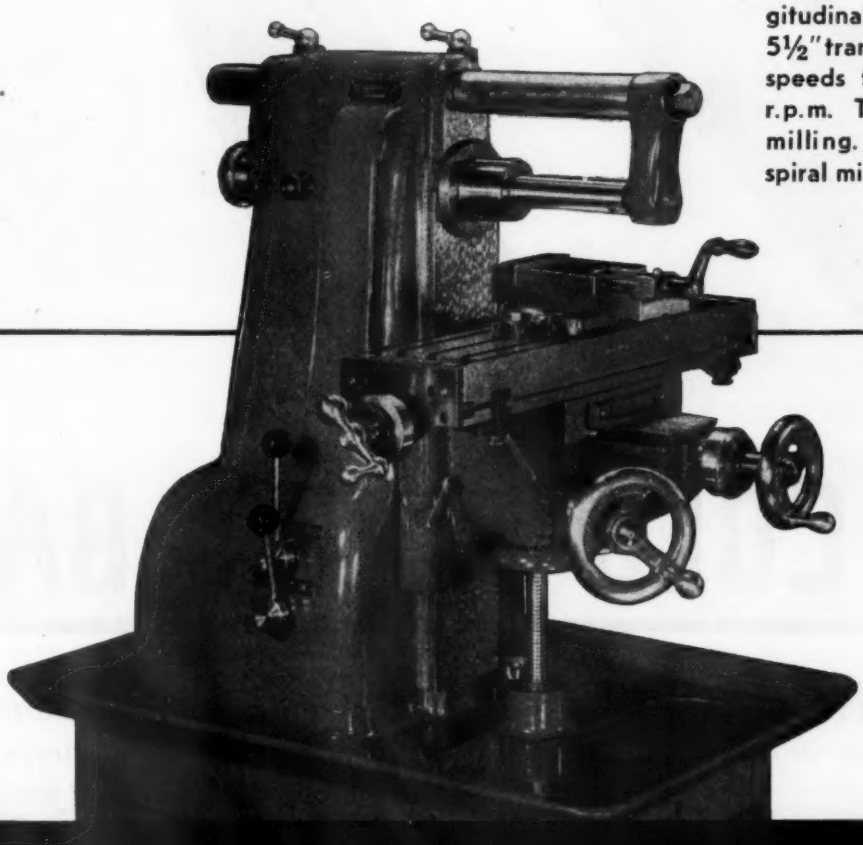
1" collet capacity, 14" longitudinal, 13¼" vertical, 5½" tranverse travel, eight speeds from 110 to 1850 r.p.m. TM model for plain milling. UM model for spiral milling.



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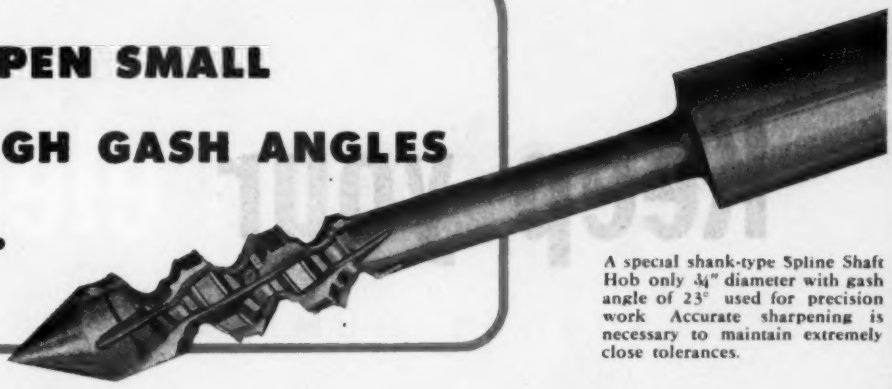
HOW TO SHARPEN SMALL HOBS WITH HIGH GASH ANGLES ACCURATELY ...



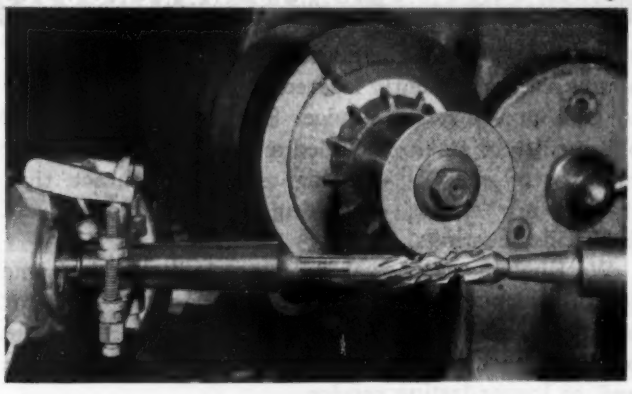
A special shank-type Spline Shaft Hob only ¾" diameter with gash angle of 23° used for precision work Accurate sharpening is necessary to maintain extremely close tolerances.

USE THE BARBER-COLMAN "MODEL HRS." COMBINATION SHARPENING MACHINE

Sharpening the hob shown above on a Barber Colman "HRS" Combination Sharpening Machine, to retain its original accuracy

It is easy enough to buy a precision hob, but to maintain the original accuracy of that hob when sharpening it is often something else again. Most precision hobs can be accurately sharpened on the well-known Barber-Colman Automatic Hob Sharpening Machines, but occasionally it is necessary to sharpen hobs with smaller diameters or shorter lead of gash than can be handled on these machines. In such cases, equally accurate results can be obtained by using the Barber-Colman "HRS" Combination Sharpening Machine

This machine has a wide range of capacity and is capable of being set up for very small work and short helical leads which must be held to extremely close tolerances Thus it is ideally suited for work which falls below the range of the standard Automatic Hob Sharpeners For example, the precision hob shown above is only ¾" in diameter and has a gash helix angle of 23°. This hob is used to cut splines to a tolerance of only .0003" on key width so the gash angle and spacing must be accurately maintained in sharpening. This is easily accomplished on the "HRS" Combination Sharpening Machine, as shown in the accompanying pictures.



Close-up of the hob sharpening operation shown at the left. The original tooth spacing and helix angle is accurately reproduced.

The "HRS" is also capable of handling many types of reamers and formed and profile type milling cutters, all with an equally high degree of accuracy on a wide variety of work. It will be found to be an extremely versatile and useful machine wherever a considerable amount of precision sharpening is needed. *Write today for our descriptive bulletin on the "HRS" Machine and learn what you can do to retain accuracy in precision cutting tools.*

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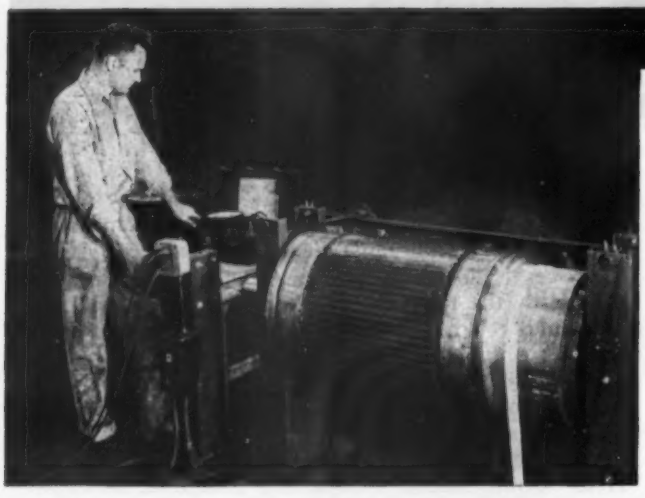
Keep your electrical



33 MANUFACTURING & REPAIR PLANTS

FOR FACTORY-PROVED REPAIR SERVICE—Every repaired electrical machine is thoroughly tested before leaving a Westinghouse District Manufacturing and Repair Plant. Special testing equipment is used for dynamic balancing, high-frequency testing and similar precision operations. Your nearest Westinghouse M & R Plant can recondition, remodel or rebuild your electrical equipment according to the high standards of the "Factory-Proved" Plan.

17 RENEWAL PARTS WAREHOUSES

RENEWAL PARTS—Westinghouse Renewal Parts Warehouses are conveniently located throughout the country to give you prompt service. Standard parts can be obtained from stock. Included are those parts normally subject to wear or burning, such as contact tips, shunts, arc chutes, operating coils, armature and field coils, bearings, etc.

Westinghouse Renewal Parts are built by the same careful workmen and on precision machines used for original equipment parts. Standardized for the original machine, they assure speedy installation as well as longer-lasting service.

12 DISTRICT ENGINEERING OFFICES

WHEN YOU NEED ENGINEERING HELP or major repairs on your plant electrical equipment, Westinghouse Field Engineering and Service is quickly available. Engineers with many years of experience with electrical and steam apparatus will diagnose your troubles and help you make the necessary repairs.

These Westinghouse engineers will work with your own engineers to keep your electrical and steam equipment at maximum productive efficiency. If you have electrical modernization or plant change-over problems, consult with our district engineers who will be glad to advise you.

J-96004

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Why take chances with overworked electrical equipment in your plant? Case after case has proved that failure to inspect, repair or recondition equipment in time results in costly shutdowns that slow down production.

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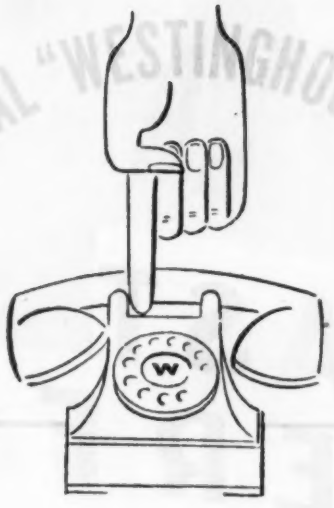

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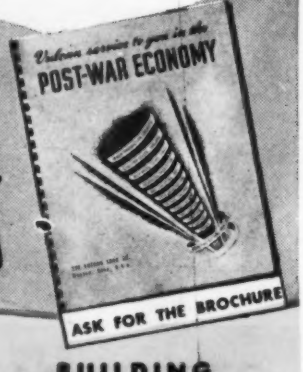

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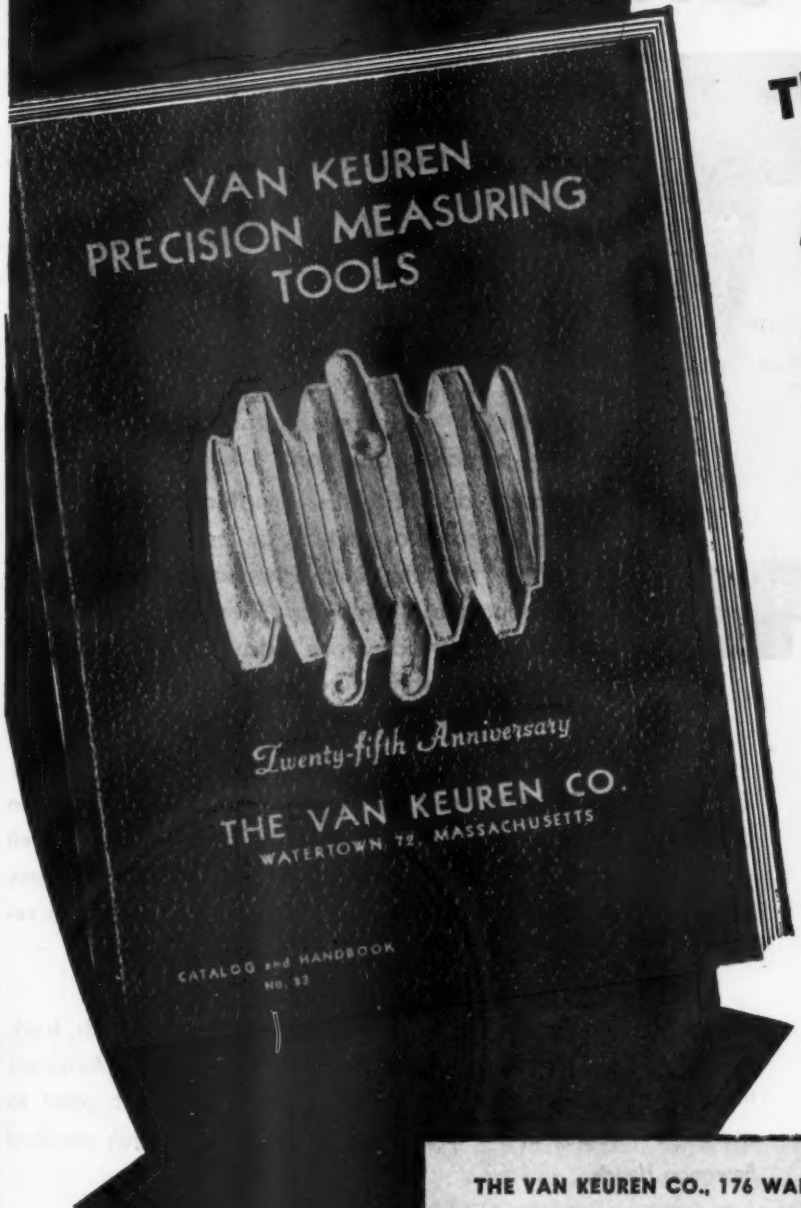

The NEW *Van Keuren* CATALOG and HANDBOOK No. 33

This new, revised Technical Catalog and Handbook contains 160 pages of practical, useful information in ready reference form on precision measuring. It describes, by text and illustration, various accepted methods and equipment for checking accuracy to hundred thousandths and millionths of an inch.

Through the use of the Van Keuren equipment described in this handbook, many outstanding improvements in production and product quality have been attained, and closer tolerances more easily achieved.

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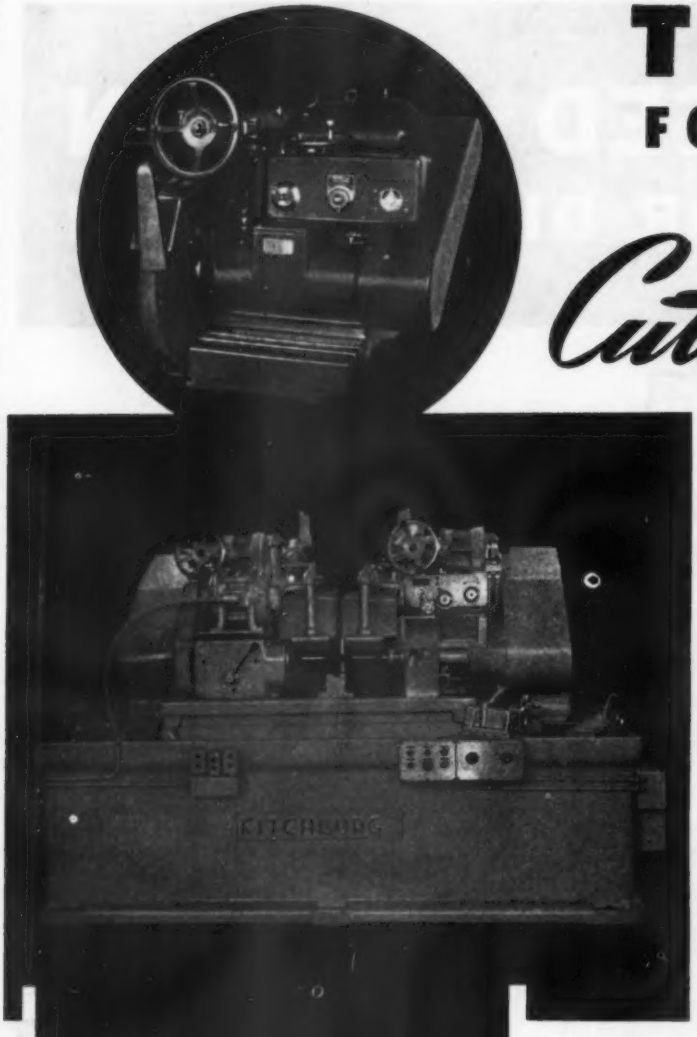

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Mass production can be applied to precision grinding only with equipment whose design incorporates simple, automatic precision controls. The Fitchburg method works on a new principle, far superior to other methods.

"Brain center" of multiple precision grinding, the Fitchburg Bowgage Head is a completely self-contained and independent grinding unit. It can be installed *singly* on standard equipment in any position and at any angle 0° to 90°, or in multiples to operate simultaneously or consecutively in mass production.

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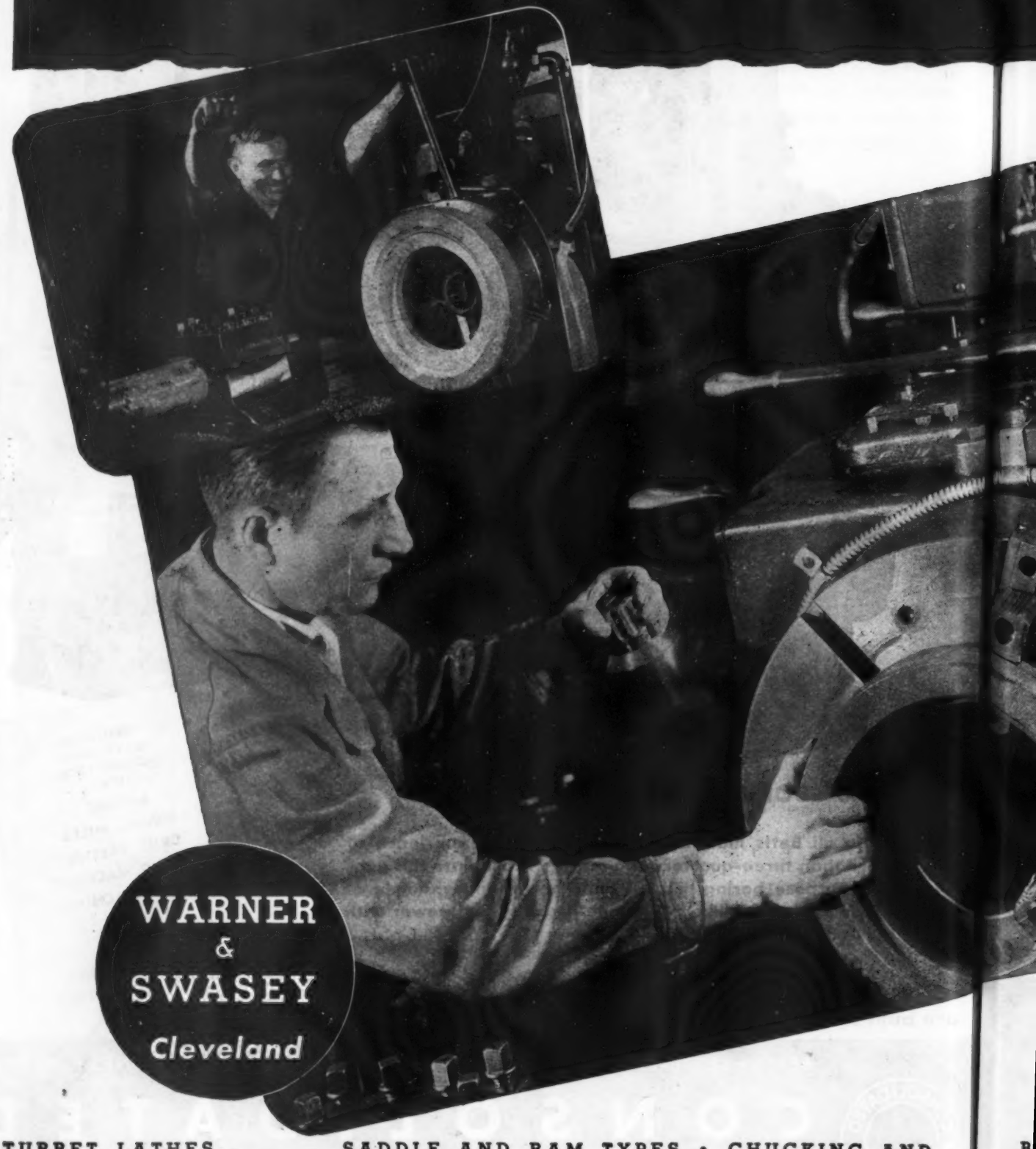
HOW TO MAKE A GOOD OPERATOR



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A GOOD turret lathe operator is a valuable man. Years of hard-earned experience have taught him the skill and know-how that make him a top producer in his field.

But good as he is, you can make him *even better* by putting a Warner & Swasey Power Chuck Wrench on his Saddle Type Turret Lathe! Chucking and releasing pieces manually is hard work any day—and today it's unproductive hard work because there's a way to do it easier, faster,—better. Heaving and wrenching on a hand chuck saps energy, takes time that is used to boost production when a power chuck wrench takes over.

The average findings from many case studies show that a good operator is able to better himself by 20% with this labor and time-saving new attachment. And better—Warner & Swasey Power Chuck Wrenches pay for themselves in increased production—often within 60 days.

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You can machine it better, faster, for less . . . . with a Warner & Swasey

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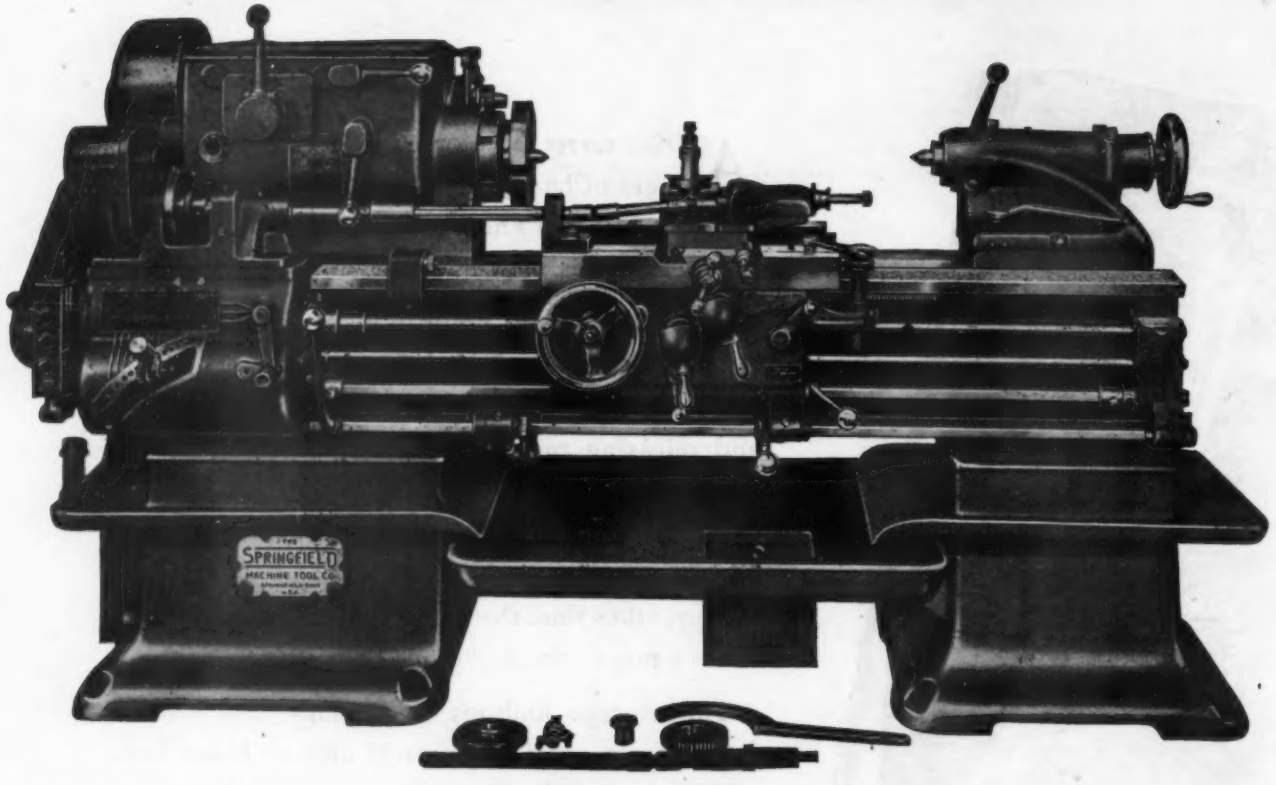


GEARED HEAD LATHES

From the ground up, a SPRINGFIELD Lathe represents superior construction and design. All heavy castings, including the bed, are cast in our own shop . . . gearing is designed for maximum efficiency . . . attachments demonstrate unusual engineering ingenuity . . . lubricating systems and power transmission are built to take it, 24 hours a day. In fact, to fully understand what SPRINGFIELD can do for you, check their superior metal turning records in other shops . . . and judge for yourself.

Under current emergency conditions make it SPRINGFIELD Geared Head Lathe . . . they'll do your job better, now and later, too! Sizes range from 14" to 30". Write concerning deliveries, prices, etc.

The SPRINGFIELD MACHINE TOOL Co.

SPRINGFIELD OHIO U.S.A.

"Put it on the Blanchard"

NO. 11 BLANCHARD SURFACE GRINDER

Grinding BEARING WASHER

...GET THESE ADVANTAGES

- Production ✓
- Adaptability
- Fixture Saving ✓
- Operation Saving
- Material Saving
- Fine Finish
- Flatness ✓
- Close Limits ✓

This hardened steel washer is only 11/32″ in diameter and is so small that it has to be located over one of the brass rings in the chuck face. Two steel rings are laid on the chuck and 109 of these washers are placed between them.

.003″ of stock is removed from each side to limits of ±.0005″ and .0005″ parallel. 300 pieces (600 surfaces) are produced per hour.

Production depends on handling time, and these figures are the actual production of a good operator but are not necessarily the maximum possible.

Send for your free copy of "Work Done on the Blanchard", third edition. This new book shows over 100 actual jobs where the Blanchard Principle is earning profits for Blanchard owners.

BLANCHARD

The BLANCHARD MACHINE COMPANY

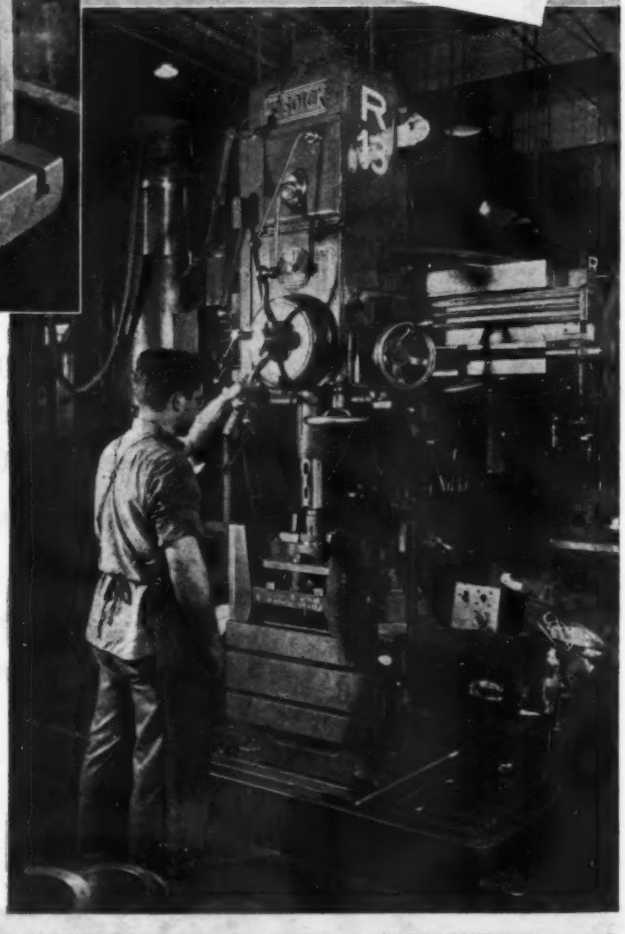
64 STATE STREET, CAMBRIDGE 39, MASS., U. S. A.

BORING AND COUNTERBORING

to limits of .0002 on a

FOSDICK RADIAL DRILL

ARMY E NAVY



● The rigidity of Fosdick Radial Drill construction is clearly indicated by the close tolerances maintained on this boring operation.

On the work illustrated four—2.834 inch holes are being bored and counterbored to limits of .0002 inch.

Various other operations are being performed including drilling and reaming several holes, counterboring others, and tapping a series of 1⅜ inch holes on the same piece before removing work from the jig.

This is typical of the time and cost saving qualities and versatility of Fosdick Radials.

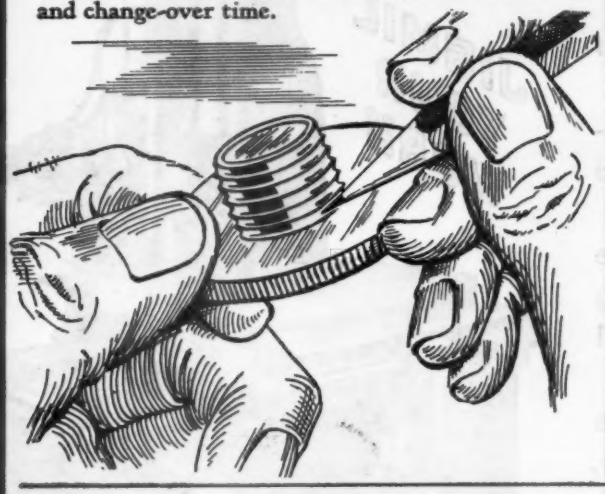
For complete information write for Fosdick Radial Drill Bulletin R. A.

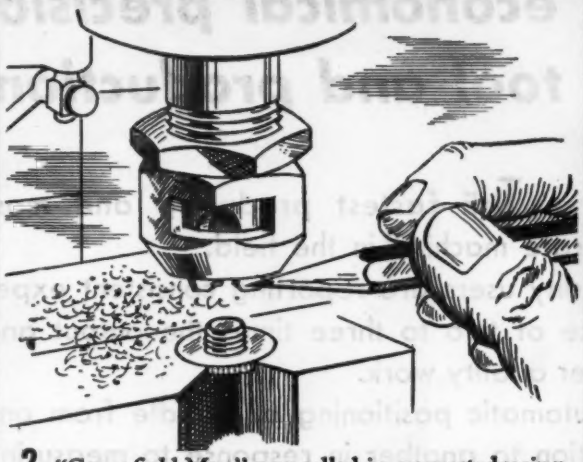
FOSDICK MACHINE TOOL COMPANY
CINCINNATI 23, ··· OHIO

"GREENFIELD MAN"

SHOW-HOW

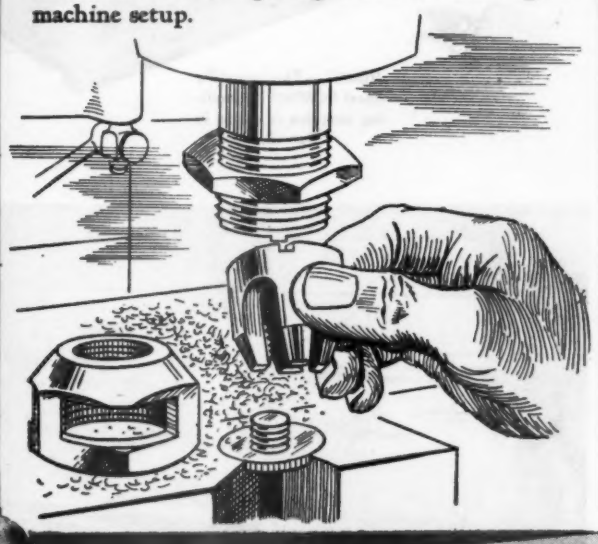
1 They were cutting an external thread on a zinc die casting. The thread length was only half an inch but it had to go to the bottom of the flange. The method in use would not deliver at high speeds, could not be adjusted quickly, required long setup and change-over time.

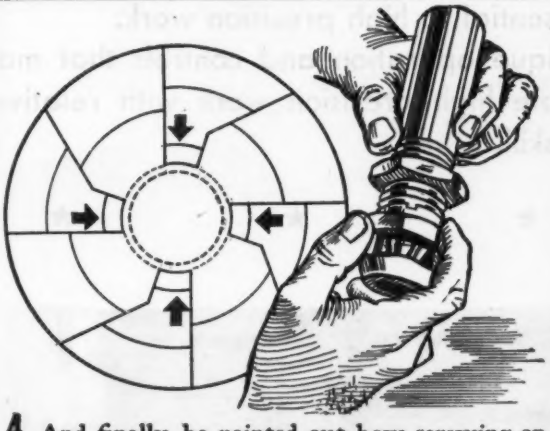




2 "Greenfield Man" was called in, suggested using an "Acorn" Die setup. Pointed out that "Acorn" Die allows threading as close to shoulder as desired since lands project out past the holder, (chamfered threads can easily be ground down by the operator or can be supplied already ground down).

3 He SHOWED HOW, by simply unscrewing the cap, the "Acorn" Die could be easily taken out of the holder for resharpening without disturbing the machine setup.





4 And finally, he pointed out how screwing on the cap compresses all four die lands to give a concentric adjustment. Accuracy of final adjustment is assured by the ground taper on the inner face of the adjusting cap which affords a perfect seat for the die lands.

Results!

The customer's own words: "The job was very troublesome . . . but thanks to the 'Greenfield Man' the trouble was over when we used an 'Acorn' Die. The R. P. M. of the Die is 1100 on and 2200 off. Production has been stepped up to 1200 pieces an hour."

Greenfield's SHOW-HOW is KNOW-HOW in action!

ON THREADING PROBLEMS SIMPLY CALL YOUR "GREENFIELD MAN" THROUGH YOUR "GREENFIELD" DISTRIBUTOR!

GREENFIELD TAP and DIE CORPORATION

The JIGMIL has proven to be a totally new approach to the problems of economical precision BORING and milling of tool and production work

THE fastest producing and most accurate machine in the field.

Many users are reporting consistent experience of two to three times the output and higher quality work.

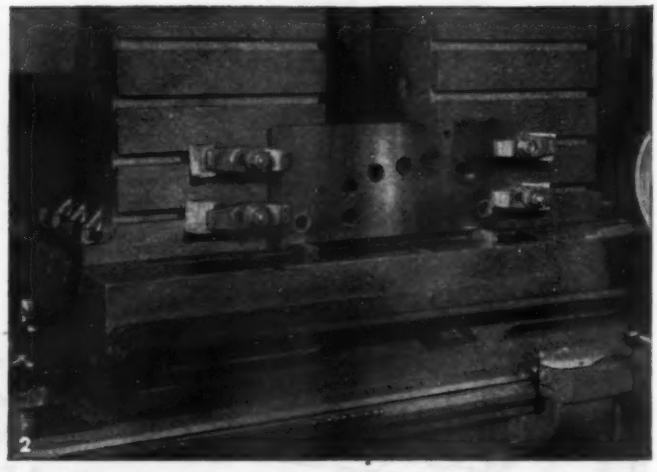
Automatic positioning of spindle from one location to another in response to measuring rods and push buttons to within less than .0001 (one ten-thousandth part of an inch).

Feather touch, pressure controlled slide locks that positively control locking uniformity, so essential to high precision work.

Unique operation and controls that make possible high precision work with relatively little skill.

★ ★ ★

JIGMIL—The world's finest BORING and milling machine is made in Detroit.



★ **No. 1—Illustration showing convenience of jig plate boring. No. 2—Eight holes precision bored. Holes spaced within .0001 with total dependence of all spacing on automatic positioning means.**

DeVLIEG MACHINE COMPANY DEVLIEG JIGMIL **450 FAIR AVE. FERNDALE 20, (Detroit) MICH.**

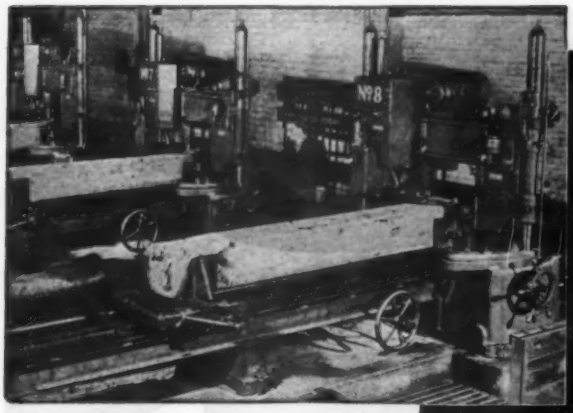
with ALCOA impact extrusions

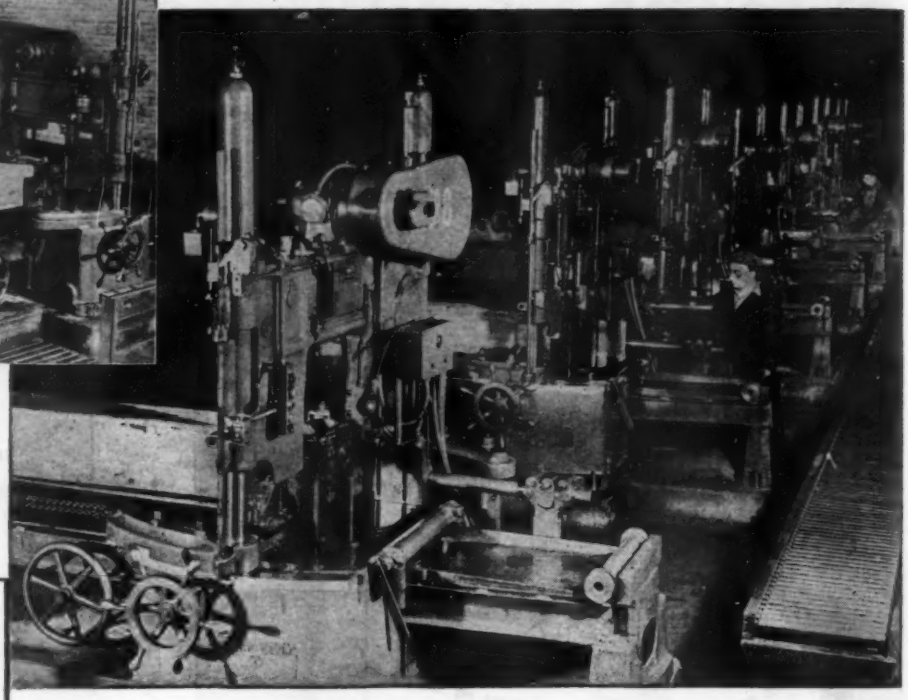
One wallop of the impact extrusion press, and see what you have—a "shell" four inches tall—that part with ears attached—or the giant cylinder. Here's high speed, low cost production at its best.

Millions like the little fellow have been produced by Alcoa for such uses as radio condenser cans and blood transfusion set containers. But war's demands for more output with less labor early recognized the potentials of the process. Alcoa answered with parts like these.

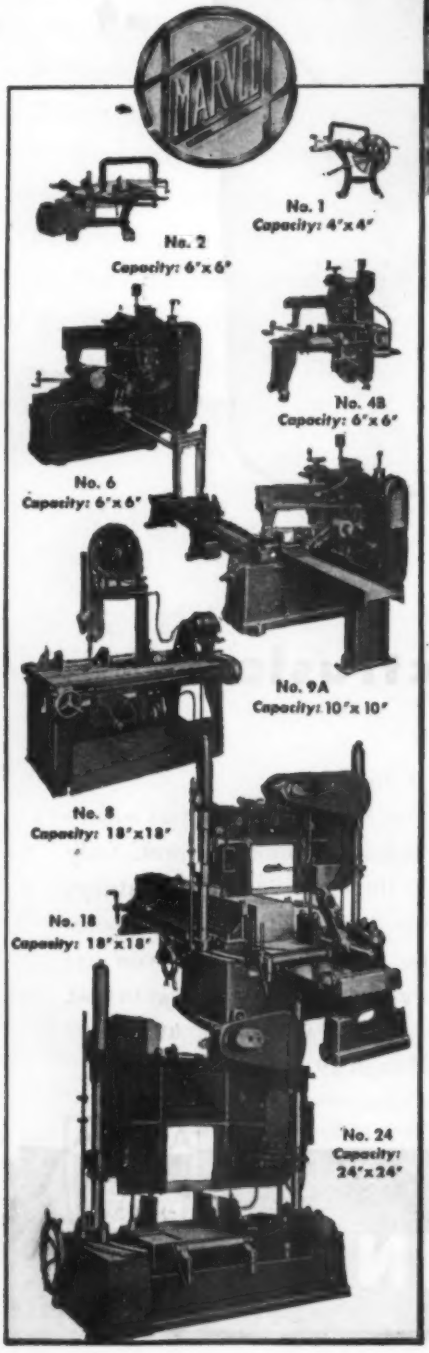
Only aluminum gives you so much to start with—parts so quickly brought to finished form. Only aluminum offers you the combination of lightness, resistance to corrosion, workability and fine appearance. Alcoa has the know-how to help you use aluminum and the impact extrusion process to best advantage. ALUMINUM COMPANY OF AMERICA, 2107 Gulf Building, Pittsburgh 19, Pennsylvania.

ALCOA FIRST IN ALUMINUM





Part of the row of No. 18 MARVEL Giant Hydraulic Hack Saws used to crop and cut-off test slices for metallurgical tests for large billets of tough alloy steels.



MARVEL No. 18 Hydraulics 12 in a row!

When a greatly expanded steel plant, near Canton, Ohio faced the problem of cropping and cutting-off test samples from large alloy billets, in WARTIME quantities and at wartime speed, they checked the performance of all types of cutting-off equipment in all their other company plants, and selected MARVEL No. 18 Giant Hydraulic Hack Saws for this "tough" job.

Now this row of twelve MARVEL No. 18 Hydraulics shown above, operating continuously, 24 hours a day on tough alloy billets of from 14" to 16" cross section, handle this tremendous, heavy duty cutting-off job without a hitch and with a minimum of man hours—only four operators per shift.

When you have a cutting-off problem your most logical first step is to check with your local MARVEL Sawing Engineer for recommendations of methods and equipment.

ARMSTRONG-BLUM MFG., CO.

"The Hack Saw People"

5700 W. BLOOMINGDALE AVE. CHICAGO 39, U. S. A.

Eastern Sales Office: 225 Lafayette St., N. Y. 12.

MARVEL SAWS

A Norton OPEN STRUCTURE Crystolon Wheel *for Grinding Carbide Tools*

IT lasts longer, cuts faster and cooler and requires less dressing than regular type silicon carbide wheels. That's what field tests are showing about the Norton OPEN STRUCTURE Crystolon Wheel on carbide jobs requiring considerable stock removal—such as the rough grinding of large single-point tools.

Stocked in size 14 x 4", 1½" rim, plate mounted in these popular specifications, 39C60-F12VP and 39C60-G12VP.

These close-up photographs of wheel surfaces tell the story. Both wheels are 60 grit, the top one is No. 7 structure the bottom No. 12 OPEN STRUCTURE. You can easily see why the No. 12 structure with its large pore space will cut both faster and cooler.

NORTON COMPANY
Worcester 6 Mass.

Distributors in All Principal Cities

W-1000

THE RIGIDTURNER

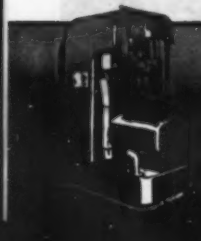
Adds **NEW** *precision to production turning*

The booklet shown tells all about the Rigidturner—what it will do—how it works—and how it will cut your costs on multiple diameter work. Write for one.

For work on which there are two or more diameters to be turned, accurately—and in quantity the Rigidturner offers advantages both in speed and costs.

For example on the gear shaft shown there are several diameters and eccentricity must be held to inside .001 inch—diameters at .002 and lengths to .005. By using the disc form cutter illustrated—on the Rigidturner—these limits are held. Two cuts are made to eliminate distortion.

The Rigidturner is a high production unit—provides more operating minutes per hour—requires less down time—uses less floor space—can be changed over quickly—and is adaptable to all types of multiple turning operations.

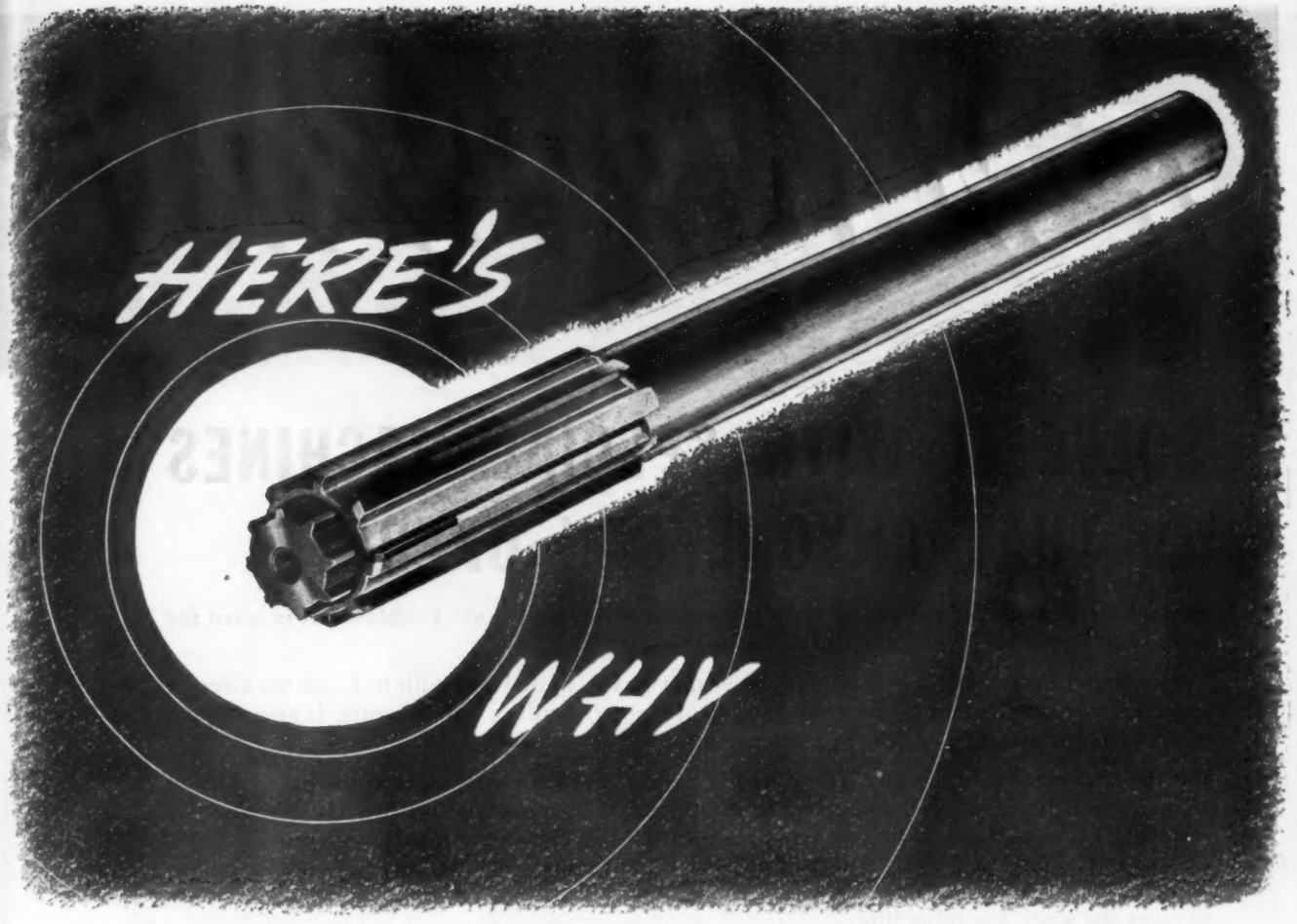


The CLEVELAND HOBBING MACHINE Company

General Offices:
1311 CHARDON ROAD
CLEVELAND 17, OHIO

Chicago Office:
624 S. MICHIGAN AVE.
CHICAGO 5, ILLINOIS

BUILDERS OF RIGIDHOBBERS AND RIGIDTURNERS



you get *GREATER ACCURACY* and *FASTER PRODUCTION* with the STAPLES EXPANSION REAMER

The tool body of the Staples Expansion Reamer is solid—not split. To expand, you simply drive in the tapered expansion plug, producing a uniform outward expansion and tilting back the cutting blades to form a new cutting edge. Easy, quick, accurate!

This exclusive, patented feature makes it possible to expand a Staples Reamer several times without a regrind. Tool life is lengthened, absolute accuracy is maintained, down time is reduced to a minimum.

Staples Reamers, Spot Facers, Counterbores, and other Carboloy-tipped circular cutting tools, were originally developed to meet the precision standards of the aircraft engine industry. Now that our production facilities are greatly increased, Staples Tools are available to other manufacturers. Send for the Staples catalog of quality cutting tools, including *standard tools available from stock.*

Staples Tool & Engineering Company
Cincinnati 25 . . . . . Ohio

Staples CARBOLOY-TIPPED CIRCULAR CUTTING TOOLS

REAMERS • CORE DRILLS • SPOT FACERS • COUNTERBORES • END MILLS • SHELL END MILLS • ALSO A COMPLETE LINE OF CIRCULAR SPECIAL TOOLS

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Birmingham, Quinn & Quinn
Boston, Arthur A. Crafts
Brooklyn, A. N. Nelson
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Chicago, Screw Machine Supply
Cleveland, Strong, Carlisle & Hammond
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Waterville, Harold W. Kimball

IF MANPOWER IS

SOLVE IT WITH SPECIAL MACHINES THAT ANYONE CAN OPERATE

Special metal-working machinery does more than solve production problems. It is often the answer to manpower difficulties, too.

For example, here is a Cross *Special Machine* that was designed and built to finish the circular grooves and simultaneously face the flanges of aircraft landing wheel struts. It speeds production by producing 3 finished pieces per hour at 80% efficiency.

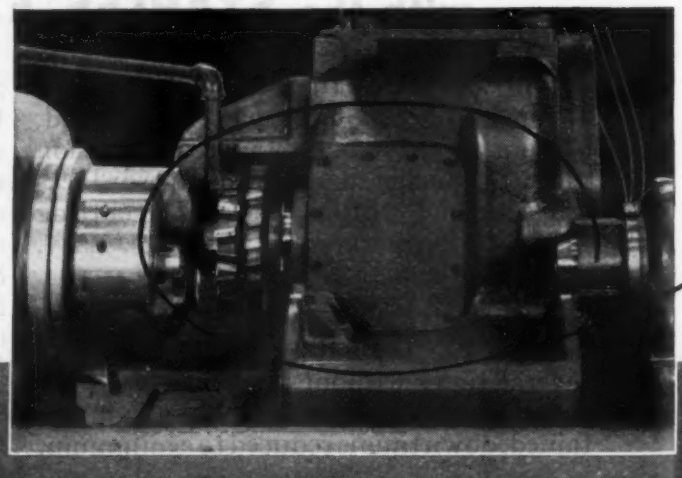
But the important thing is this: The operating cycle is completed simply at the push of three electric push buttons. An inexperienced or unskilled operator pushes the first button, and the work is located and clamped. Another push button closes the headstock spindle chuck on the work close to the cut. A third push button starts the machine, and the cutters feed to depth as the work rotates. When the cut is completed, the cutter heads withdraw automatically to clear the work for reloading.

The result: Anyone can operate the machine. The automatic work cycle leaves the operator free to attend other machines. The whole operation is ideally suited to female labor.

Fast production is everyone's problem—now, and tomorrow. But the Cross idea in designing special machinery is an idea that solves *manpower* problems, too, by creating machines that perform one or more metal-working operations automatically at the push of a button.

There are 35 detailed case histories similar to this one in the new Cross Catalog No. 240. If you have a production problem or a *manpower* problem, the solution may be yours for the asking. Just write

THE CROSS COMPANY
Detroit 7, Michigan, Department 131

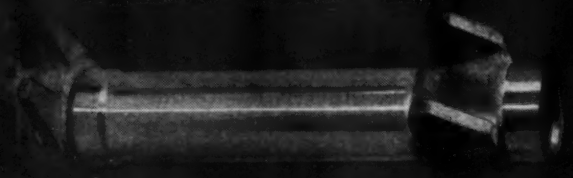


CROSS

New York • Chicago • DETROIT • Cleveland • Cincinnati

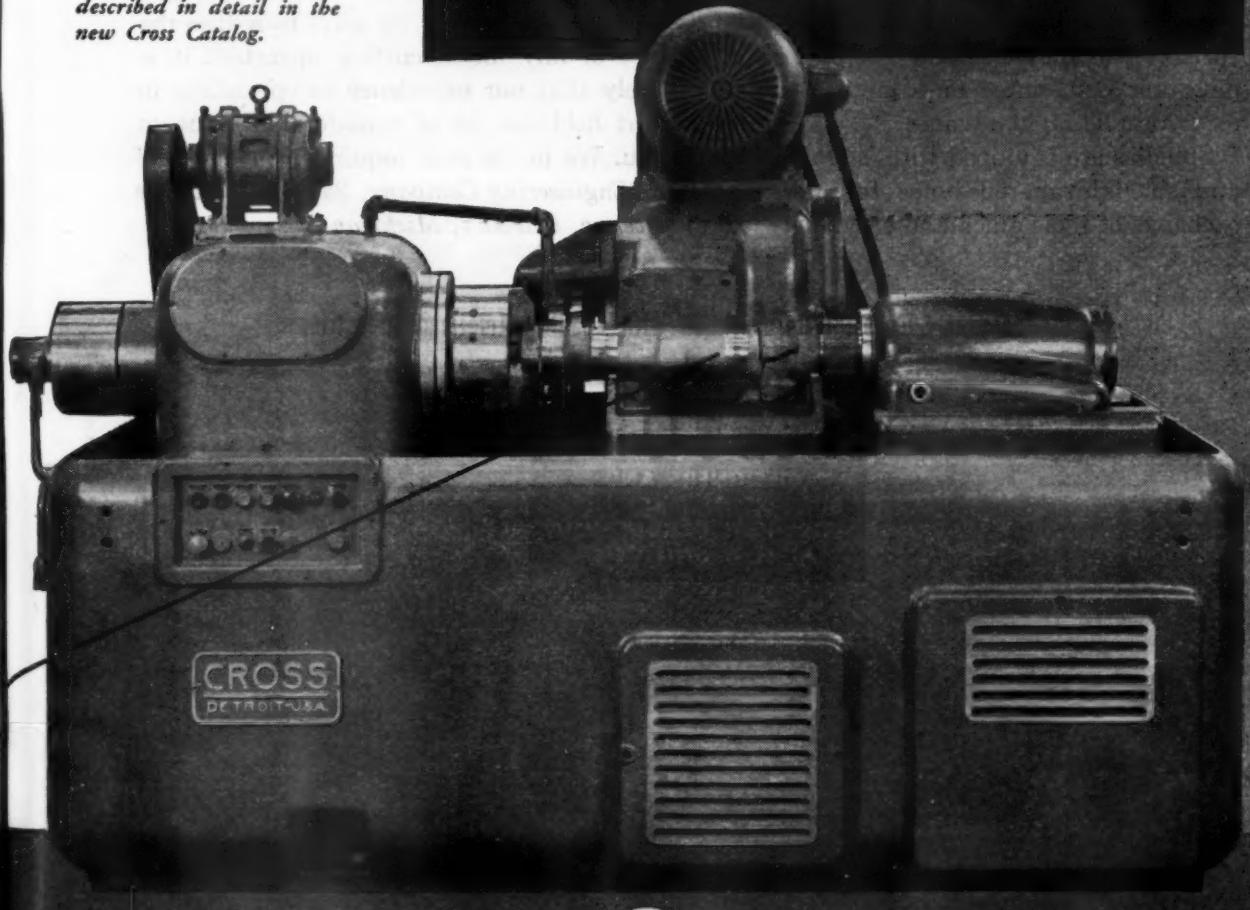
YOUR PROBLEM...

FINISHING THE CIRCULAR GROOVE



SIMULTANEOUSLY FACING THE FLANGES

Cross Special Rotary Milling Machine No. 18600—described in detail in the new Cross Catalog.



S-20

SPECIAL MACHINES

for automatically performing any one or a combination of metal cutting operations
TURNING · MILLING · DRILLING · BORING · REAMING · TAPPING · GRINDING

Snyder Special for BORING, FACING *and* TAPPING
Heavy-Duty Valves for Oil Fields

Machining valves to handle the oil that keeps our war machine running was slow and costly by conventional methods and called for skilled help which was hard to get. For one particular manufacturer of these heavy-duty valves, this Snyder special-purpose boring, facing and tapping machine solved these problems effectively.

Boring and facing is done with a four speed, single spindle head which is driven and advanced into the work by a Snyder self-contained hydraulic guide bar unit.

To the left of the operator and in front of one of the two boring units is installed a lead screw tapping device which has also a variable tool spindle speed. The entire tapping unit is mounted on a guide bar slide for hydraulic rapid advance.

Spindles are equipped with a breech lock and special tapered holes to make the exchange of tools quick and easy.

The index table is mounted on a manually operated elevating mechanism which compensates for the various sizes of work and also brings the tools concentric with the boss on the work-piece. This table is indexed for 180° with an intermediate index for the tapping operation.

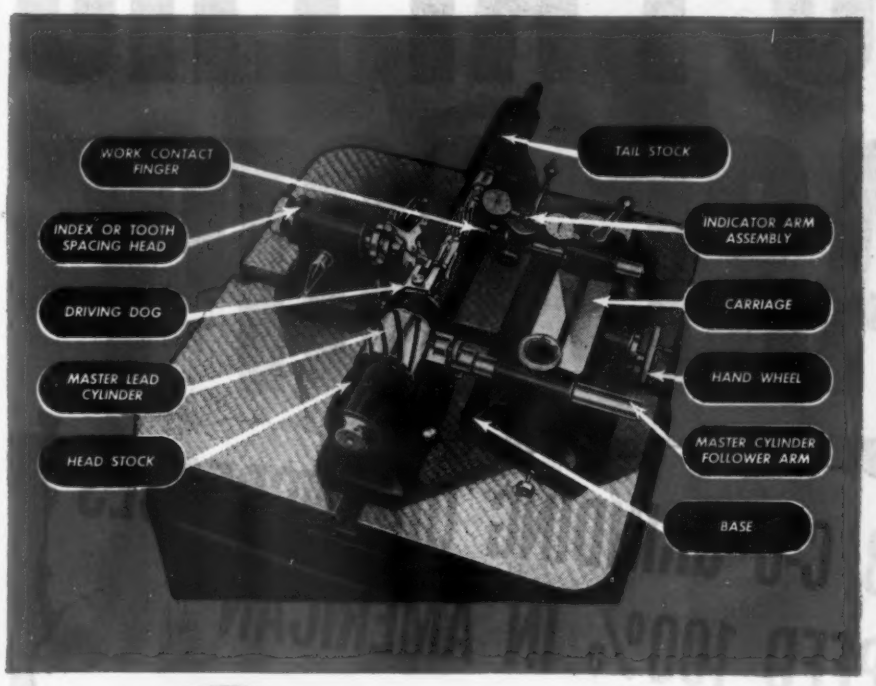
Although production in terms of units is relatively low, the savings accomplished by such machines are substantial. These savings affect time, handling, operator fatigue, operating skill, quality and uniformity of finish. Similar savings can be accomplished in the machining of other types of large, heavy parts.

If you are looking for ways to reduce the cost of any metal cutting operation it is likely that our experience as specialists in that field can be of considerable value to you. We invite your inquiries. *Snyder Tool & Engineering Company, 3400 E. Lafayette Avenue, Detroit 7, Michigan.*

20 Years of Successful Co-operation with Leading American Industries

SNYDER
DESIGNERS AND BUILDERS OF MACHINERY FOR HIGH PRODUCTION AT LOW UNIT COST

CHECK GEAR ERRORS



INDEX
HELIX ANGLE
LEAD
TOOTH SIZE
ECCENTRICITY
INTERFERENCE
WOBBLE

The Red Ring Universal Gear Checker is a simple, compact instrument for accurately checking dimensional errors in either spur or helical gears. With the application of special equipment, this machine will check leads accurately against a master lead gage, errors being registered on a "tenth" indicator. Its simplicity makes it possible to check gears quickly without sacrificing accuracy. Its ingenious design practically eliminates the human equation and therefore the need for skilled operators.

The Red Ring Universal Gear Checker is built in three sizes, the 12" size for gears from ¼" to 12-11/16" O.D., the 18" size for gears from 2" to 18⅞" O.D., and the 24" size for gears from 3" to 24⅞" O. D.

WRITE FOR DESCRIPTIVE BULLETIN

NATIONAL BROACH AND MACHINE CO.

RED RING PRODUCTS

5600 ST. JEAN • DETROIT 13, MICH.

Specialists on SPUR AND HELICAL INVOLUTE GEAR PRACTICE

Originators of ROTARY SHAVING AND ELLIPTOID TOOTH FORMS

TOKYO PAPERS PLEASE COPY

MARATHON 873 C-6 GRINDING OIL INCREASES WORK SPEED 100% IN AMERICAN AIRPLANE PARTS PLANT

Cuts grinding time in half. Reduces wheel dressings 75%

Amazing grinding oil actually doubles efficiency of men and machines

Cuts grinding time in half. Reduces wheel [illegible] 75%. Amazing grinding oil actually [illegible] of men and machines. [illegible] this actual report!

[redacted] PRECISION THREAD GRINDER SPECIFICATIONS

CUSTOMER	[redacted]	SERIAL	
ADDRESS	[redacted]	STYLE	233-L
MATERIAL	[redacted]		
HARDNESS	35 to 36 Rockwell		
DIAM. OF THREADS	6¼"		
PITCH	⅓" Lead 2"		
FORM	29 Acme		
LENGTH OF THREADS	21"		
TYPE OF OIL	[redacted]	Ohio Oil Marathon 873-C6	
ROUGH CUTS REQ'D	3		
FINISH CUTS REQ'D	1	1	
DEPTH OF R. CUT ON P. D	.008	.008	
DEPTH OF F. CUT ON P. D	.004	.004	
GRINDING TIME PER PC	88 Minutes	44 Minutes	
GR. WHEEL SPEC.	80-R-100 Carborundum Vitrified		
GR. WHEEL SPEED	1350 R. P. M.	1450 R. P. M.	
WORK SPEED	2 R. P. M.	4 R. P. M.	
DRESSINGS REQ'D		4	
DEMONSTRATOR		DATE [redacted]	

Not just a claim! Read this actual report!

Bad news for the Nips. But mighty welcome news to you—if you're looking for a grinding oil that will speed up production in your plant. C-6 is clean, transparent—operators can actually read a scale through it. Its lower working temperature means greater accuracy. Get the facts. Call in an Ohio Oil Company Lubrication Engineer to specify cutting and grinding oils that will boost production, save time, cut costs throughout your plant. Phone, write or wire, today.

A complete line of cutting and grinding oils for every requirement

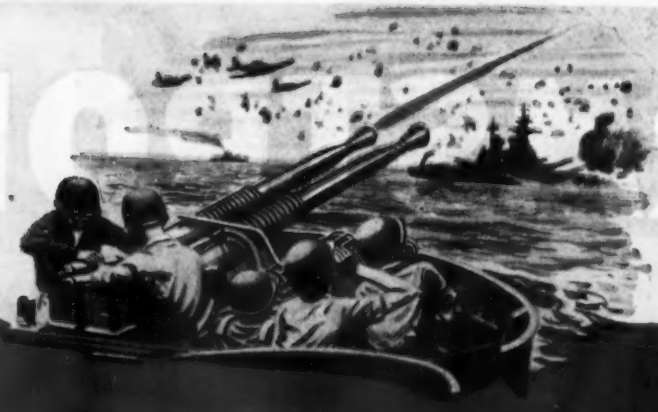
The OHIO OIL COMPANY

GENERAL OFFICES: FINDLAY, OHIO

District Offices: Robinson, Ill.; Indianapolis, Ind.; Louisville, Ky.

MARATHON

PRODUCERS OF PETROLEUM SINCE 1887



Versatility in Die-casting by...

AUTO-LITE

Gimbal ring for automatic pilot, precision machined with extremely fine tolerances.

Aircraft carburetor part intricately designed and particularly difficult to cast.

Miscellaneous fine parts of aluminum and zinc, carefully machined.

Aircraft cable drum with bronze bushing cast in.

.30 cal. ammunition clip, moulding finish and completely assembled.

THE almost limitless versatility of the die casting process is realized completely at Auto-Lite's big plant in Woodstock, Illinois. Here are complete facilities for die casting, trimming, precision machining, plating, painting, cronaking and anodizing, all under one roof. To insure quality control Auto-Lite die castings are subjected to spectographic analysis, metallographic studies, physical testing, X-ray inspection and heat treating.

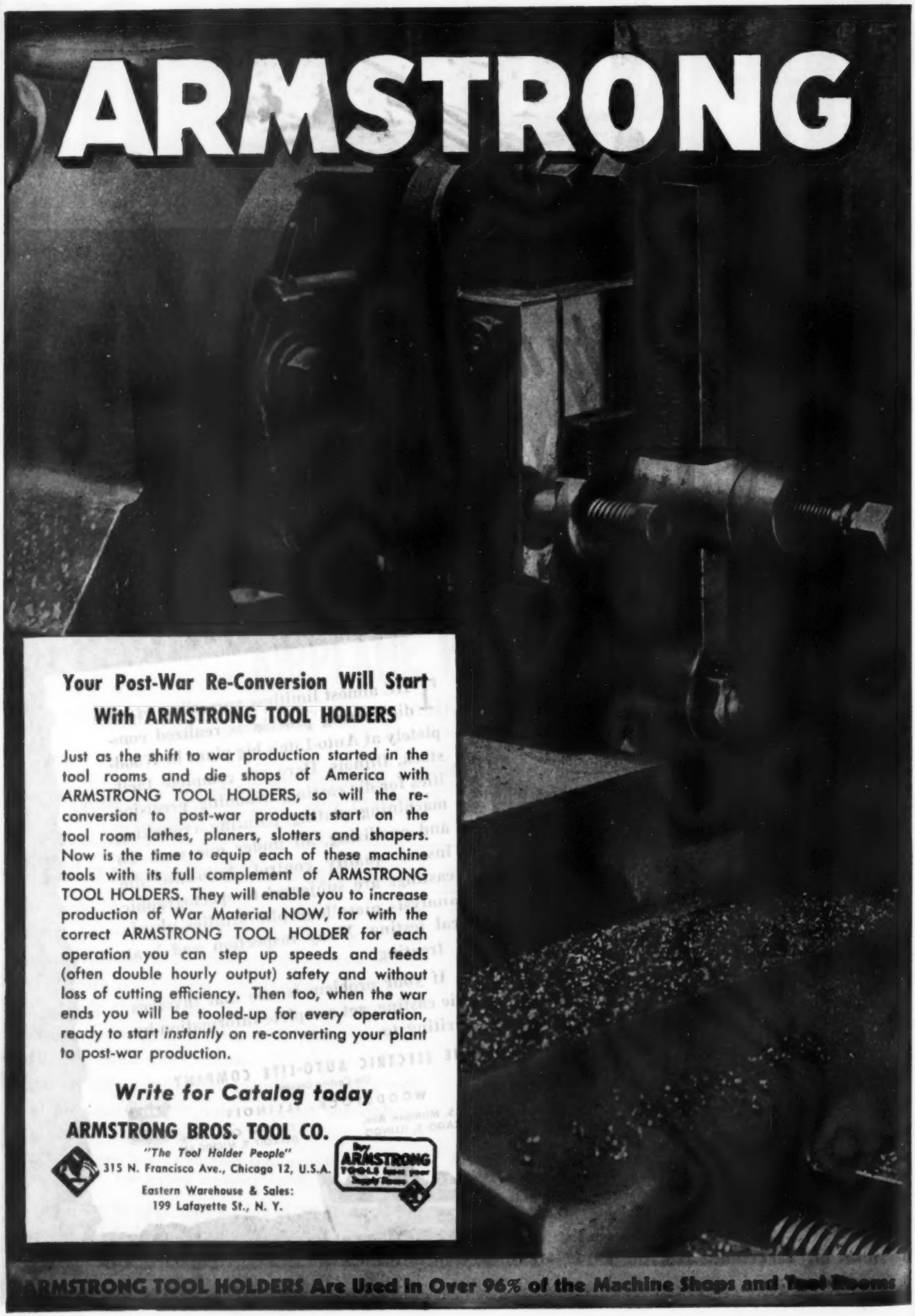
If your problem is one that involves die casting, get complete information by writing to

THE ELECTRIC AUTO-LITE COMPANY
Die Casting Division
WOODSTOCK, ILLINOIS
600 S. Michigan Ave.
CHICAGO 5, ILLINOIS
723 New Center Bldg.
DETROIT 2, MICHIGAN

BUY WAR BONDS

TUNE IN "EVERYTHING FOR THE BOYS" STARRING DICK HAYMES, EVERY TUESDAY NIGHT, NBC NETWORK

ARMSTRONG



Your Post-War Re-Conversion Will Start With ARMSTRONG TOOL HOLDERS

Just as the shift to war production started in the tool rooms and die shops of America with ARMSTRONG TOOL HOLDERS, so will the re-conversion to post-war products start on the tool room lathes, planers, slotters and shapers. Now is the time to equip each of these machine tools with its full complement of ARMSTRONG TOOL HOLDERS. They will enable you to increase production of War Material NOW, for with the correct ARMSTRONG TOOL HOLDER for each operation you can step up speeds and feeds (often double hourly output) safety and without loss of cutting efficiency. Then too, when the war ends you will be tooled-up for every operation, ready to start *instantly* on re-converting your plant to post-war production.

Write for Catalog today

ARMSTRONG BROS. TOOL CO.

"The Tool Holder People"

315 N. Francisco Ave., Chicago 12, U.S.A.

Eastern Warehouse & Sales:
199 Lafayette St., N. Y.

Buy ARMSTRONG TOOLS from your Supply House

ARMSTRONG TOOL HOLDERS Are Used in Over 96% of the Machine Shops and Tool Rooms

RECONVERSION *News Flash*

Standard P&W Small Tools and Gages Again in Stock at Branches

Our thanks go to General Eisenhower, his fighting men, our hard-hitting allies and the forces of retribution headed straight for Tokyo. Their tremendous achievement now opens the way to some reconversion for American industry. While we still are producing thousands of tools needed for war products, our production now exceeds war needs. Once more we have restored our prewar policy of maintaining strategically located stocks of all standard small tools and gages in order to quickly service consumer convenience and necessity.

With speedy, orderly reconversion dependent upon adequate tools and tooling, the service at P&W branches will help our customers speed up post V-E Day production by re-building their inventories of essential tools.

For complete details on tools and gages stocked, and other valuable service available from all branches, phone or write any office listed below or get in touch directly with Accuracy Headquarters at West Hartford.

BRANCH OFFICES

BIRMINGHAM 3, ALA.	2nd Ave. & 21st St. N. Tel. 3-0668	LOS ANGELES 11, CALIF.	2675 Santa Fe Ave. Tel. Lucas 8187
CAMBRIDGE 42, MASS.	238 Main Street Tel. Kirkland 5875	NEW YORK 6, N. Y.	117 Liberty Street Tel. Worth 2-5830
CHICAGO 6, ILLINOIS	565 West Washington Blvd. Tel. Franklin 2720	PHILADELPHIA 8, PA.	401 N. Broad Street Tel. Walnut 1140
CINCINNATI 2, OHIO	236 East 9th Street Tel. Parkway 3112	PITTSBURGH 19, PA.	613 Grant Building Tel. Atlantic 9577
CLEVELAND 14, OHIO	1433 East 12th Street Tel. Cherry 8034	ROCHESTER 4, N. Y.	89 East Avenue Tel. Stone 2893
DETROIT 11, MICH.	2836 East Grand Blvd. Tel. Madison 1711	ST. LOUIS 1, MISSOURI	710 N. 12th Blvd. Tel. Central 6770

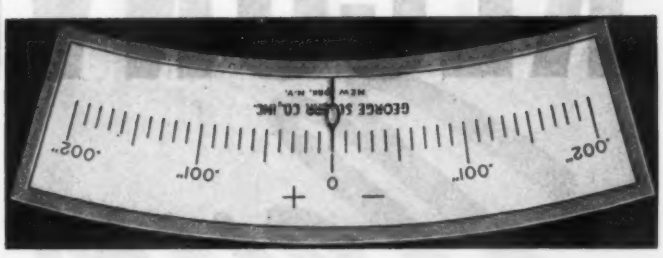
SAN FRANCISCO 3, CALIF. 1331 Howard Street
Tel. Market 7363

PRATT & WHITNEY

Division Niles-Bement-Pond Company

WEST HARTFORD 1, CONNECTICUT

You can see "tenths" easily with the SCHERR COMPARITOL



ACTUAL SIZE OF SCALE

It multiplies measurements visually by *more than seven hundred*—actually makes .001" occupy the space of three-quarters inch on the scale. On this basis it's easy for even untrained help to do close and accurate inspection.

No need for educated "feel" as with micrometers or snap gages. The Comparitol gives the same result, no matter who uses it.

ONLY TWO MOVING PARTS in the patented and exclusive lever construction. Extreme sensitivity with light tension, and almost nothing to wear—a construction that you might call "ruggedly delicate." No electrical elements, no changes due to heat, no short circuits. Just consistent measuring in a tool tough enough to stand ordinary shop usage, with all the refinements of a laboratory instrument.

WITH METRIC SCALE TOO—If desired the Comparitol can be supplied with scale in metric divisions, reading to .002mm.

Many attachments available for special uses—fitted V-blocks, tables, special forms. Feeler point either hardened steel ball, or flat as desired. Also diamond and tungsten carbide points.

Hundreds of shops are today making new speed records with Comparitol in the accurate inspection of small parts with critical dimensions. Is yours among them? If not, write us for full details and descriptive bulletins.

USE ULTRA-CHEX BLOCKS
to set your Comparitol. 34 standards give 80,000 combinations between .300" and 8", in steps of 1/10,000". Complete set, $125.00.

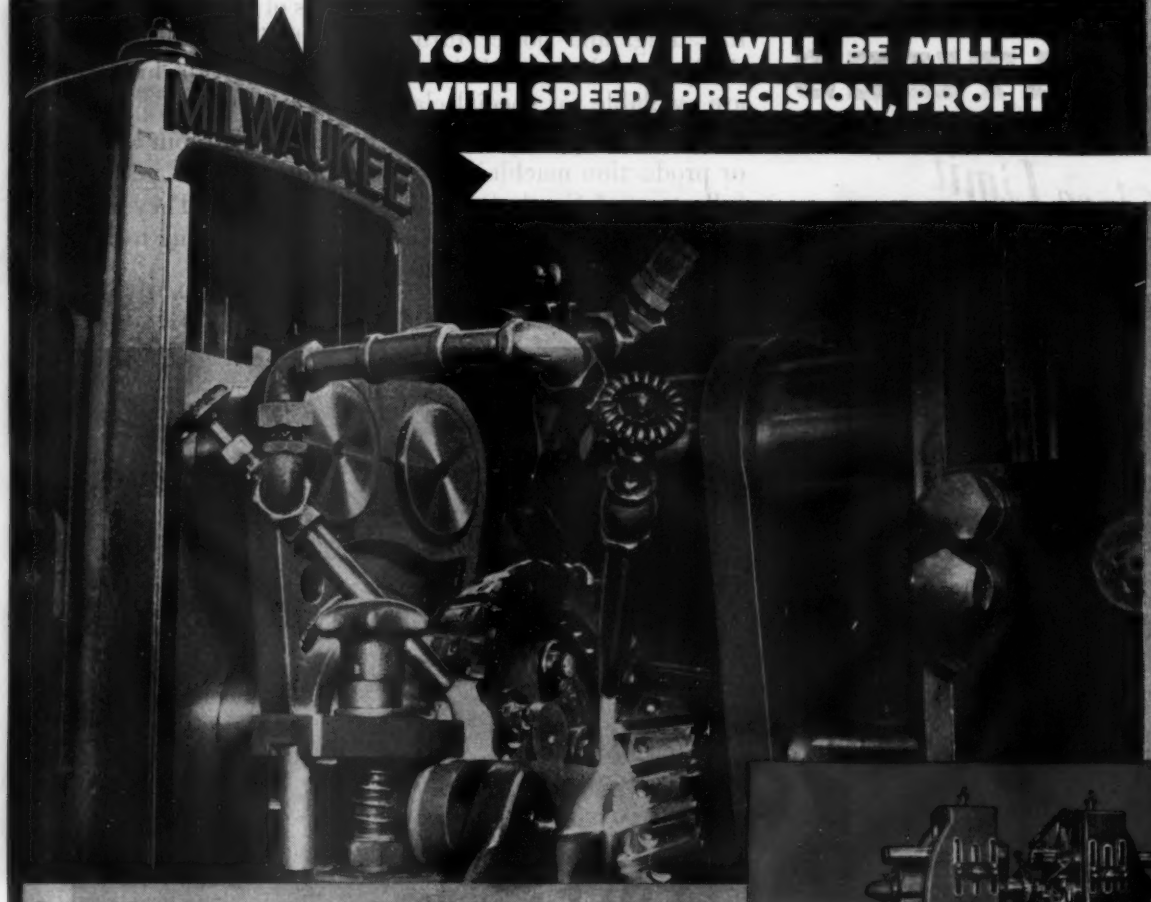
THE EASY WAY TO CHECK PLUG GAGES

GAGE MAKERS—GAGE USERS
Save time by finishing plug gages from the Scherr set of plug gage blanks. 36 blanks, for plugs .029" to 1.010". Also handles. Complete set, $49.50.

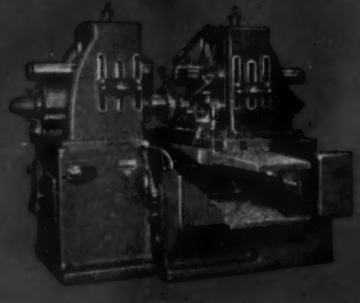
GEO. SCHERR CO., Inc. 201 LAFAYETTE STREET NEW YORK 12, N. Y.

"WHEN YOU PUT IT ON A *Milwaukee*"

YOU KNOW IT WILL BE MILLED WITH SPEED, PRECISION, PROFIT



The straddle milling operation on this 1236 Milwaukee Duplex Milling Machine requires flexibility in spindle positioning because the milling cuts are at different levels. . . . Independent spindle speeds are necessary because the job required the use of two diameters of cutters. . . . "Anchoring" the spindle quill with the quill support mounted on the overarms, insures vibration-free operation in either "out" or "in" position.



1800 Series Milwaukee Duplex Milling Machine

ARMY E NAVY

KEARNEY & TRECKER CORPORATION

MILWAUKEE 14, WISCONSIN

KNOWN as "production type" machines the Milwaukee Duplex series of milling machines offer important advantages:

– automatic trip table mechanism provides for continuous cycles of table movement.

– adjustable nut for *climb milling* eliminates backlash in the table feed screw. This feature permits machining a workpiece ordinarily difficult to hold for milling operations — results in increased feeds, improved finishes — anchored quill construction securely supports the quill behind the spindle nose in all positions.

These features plus the compact rigidity and sturdiness designed and built into the machine assure fast, precision production at less cost. Write for new Bulletin No. B20, giving complete details on the Milwaukee Duplex and Simplex Series of Milling Machines.

Milwaukee Machine Tools

SOUTH BEND TOOLROOM LATHES

for Close Limit Precision Machining

When unpredictable precision jobs tax toolroom facilities, South Bend Toolroom Lathes help keep the work going smoothly. Their superior design and careful workmanship make close limit toolroom work easier. Their smooth power and rugged construction make them equally popular for exacting production operations.

Versatility is often as important as accuracy. The ease with which set-ups can be changed for numerous precision operations, plus wide ranges of spindle speeds, threading, and power turning and facing feeds effectively contribute to their efficiency. Many attachments are available for special classes of work.

Whether your problem is precision toolroom work, or production machining to toolroom standards, get the full story of South Bend Toolroom Lathes. They will simplify your work. Made in five sizes, 9″ swing to 16″ swing. Write for New Catalog No. 100-D.

SOUTH BEND 16" TOOLROOM LATHE

SPECIFICATIONS

SOUTH BEND 16" TOOLROOM LATHE

Swing Over Bed . . . . . 16¼″
Maximum Collet Capacity . . . . . 1″
Bed Lengths . . . . . 6′, 7′, 8′
Spindle Speeds (8) . . . . 21 to 725 r. p. m.
Thread Cutting Range (48) . 4 to 224 per in.

TRAINING HELPS

Sound films, operator's handbooks, booklets, wall charts, and bulletins on lathe operation and care are available for training new lathe operators. Write for Bulletin No. 21-D for full information.

Lathe Builders For 38 Years

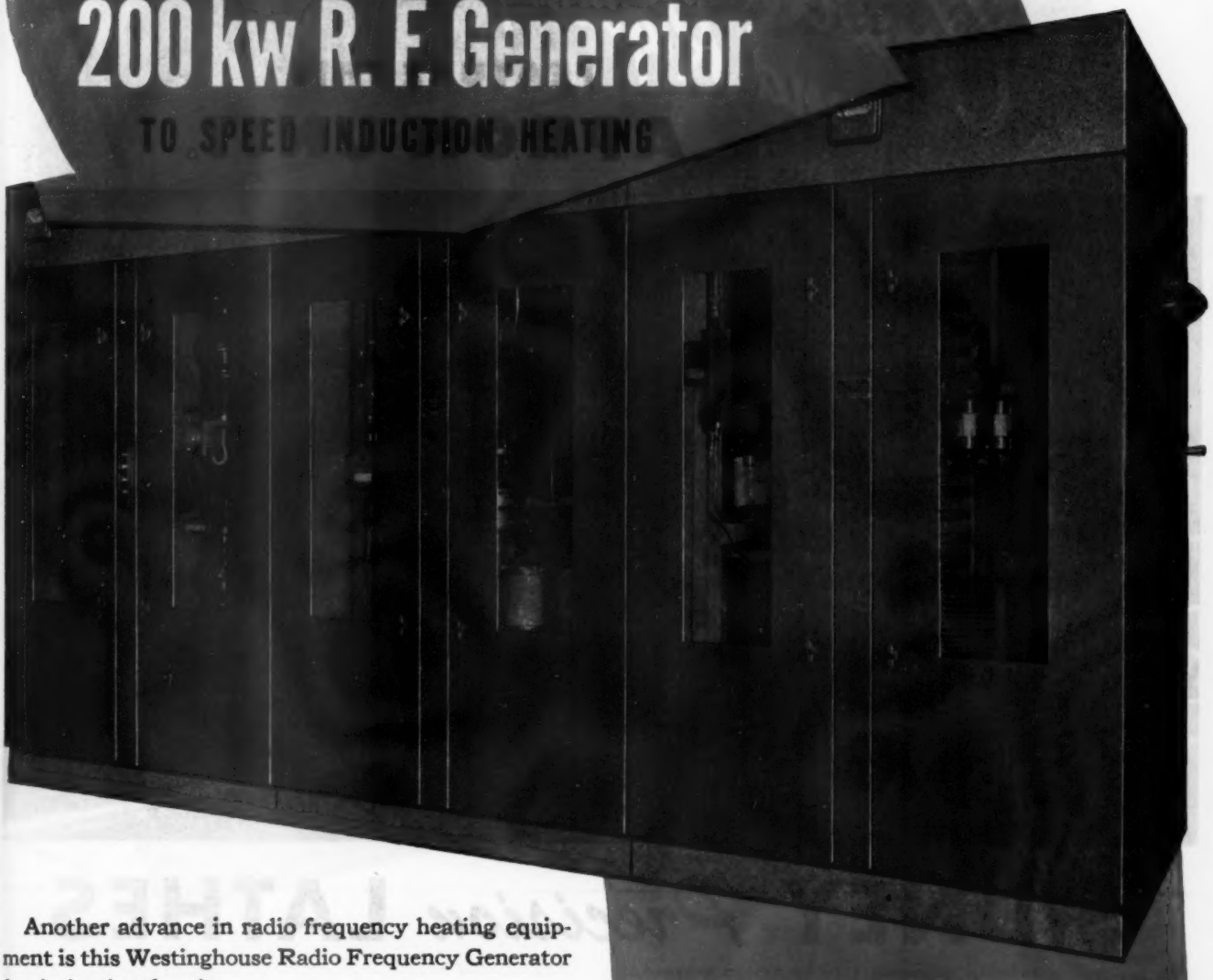
SOUTH BEND LATHE WORKS

"A" EAST MADISON STREET • SOUTH BEND 22, INDIANA

Here's a

200 kw R. F. Generator

TO SPEED INDUCTION HEATING



This 200kw, 450kc r.f. generator may be installed adjacent to the work, or at a remote point. Dead-front construction safeguards operators. From left to right, cubicles contain rectifier and control panel, radio frequency oscillator and tank circuit.

Another advance in radio frequency heating equipment is this Westinghouse Radio Frequency Generator for induction heating.

This 200kw generator is a complete power source, built with all the performance characteristics of Westinghouse industrial equipment. Timing, for example, is automatic according to a predetermined load cycle and power consumption is determined by the work being done.

Consecutive heats can be repeated automatically without interruption or duplicated at any future time with accuracy. Once the generator is adjusted to a process, operation requires only pushing buttons and setting dials to calibration data.

The 200kw generator is one of a complete Westinghouse line including 2, 5, 10, 20, 50 and 100kw sizes. For more information, ask for Descriptive Bulletin 85-800, or give your nearest Westinghouse representative your specific problem. **Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.**

J-08108

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

Electronics at Work

Convenience and Rigidity FEATURE THIS APRON UNIT

SIDNEY *Precision* LATHES

● The cross feed and compound screws are furnished with adjustable nuts and tapered gibs to compensate for backlash and wear. Both are equipped with large micrometer dials and provided with ball thrust bearings.

A micrometer stop on the cross feed provides an adjustable depth stop for turning or threading—and for internal and external thread chasing.

The swivel of the compound rest is graduated 90° each way from center and is securely held in place by four bolts.

Note center gib provided in addition to front and rear gibs under Vee ways. All of these points of design and construction make for convenience and rigidity of operation.

The SIDNEY MACHINE TOOL COMPANY
Builders of Precision Machinery
SIDNEY · OHIO
ESTABLISHED 1906

Design to *Minimize* Maintenance

Insert KENNAMETAL At *Critical* Wear Areas

LIKE the jewels in a fine watch, small pieces of Kennametal, incorporated at critical points of excessive wear, assure enduring precision performance. For example:

(A) Kennametal inserts in the grinder table provide a true, flat surface that shows no appreciable deterioration after many months' service.

(B) Inserts of Kennametal stand up for weeks under severe abrasive action of wire cleaning brushes which cut deep into steel leveling guides in less than one day.

(C) Steel sliding surfaces of abrasive saw rest wore quickly, until reinforced with flat blanks of Kennametal, which make smooth, durable surface that outwears steel up to 100 times.

These typical applications of Kennametal, in simple forms, suggest how its unique wear-resistant properties can be utilized to make your product give better service at less cost. Keep in mind that Kennametal can be molded into almost any shape, limited only by reasonable proportions, but . . .

For the present—because our efforts are devoted primarily to the manufacture of tools for use in war plants—we can serve you most effectively if you plan to use readily available shapes of Kennametal, such as flat blanks, balls, and discs. However, if your wear problem is not easily solved with standard shapes, don't hesitate to ask us to suggest how it may be solved through freer, more imaginative application of Kennametal—the metal that masters wear.

Why KENNAMETAL Withstands Wear . . .

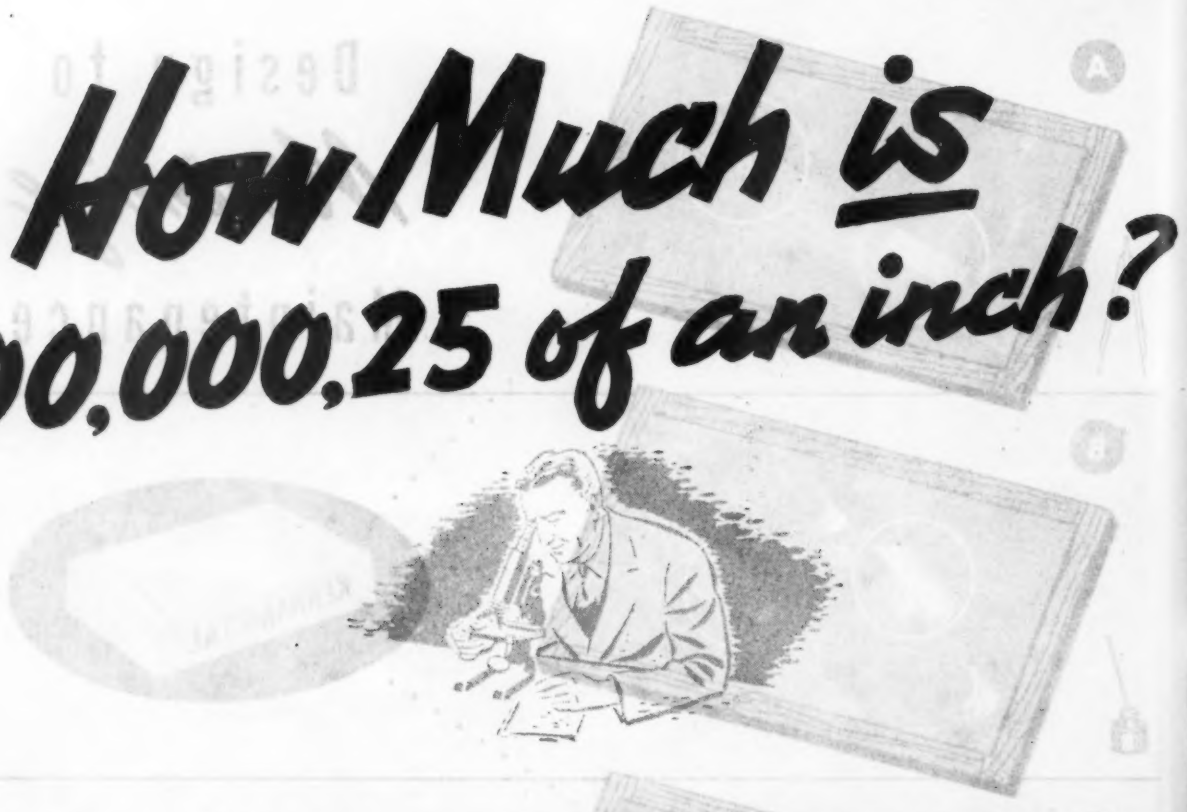
- **78 Rockwell C hardness, as compared to 66 for hardened tool steel.**
- **Low coefficient of friction with other metals; non-galling.**
- **Dimensionally stable; creep is negligible.**
- **Modulus of elasticity is 2 to 3 times that of steel; effective resistance to deformation.**
- **Highly resistant to corrosion, erosion, and oxidation by electric arcs.**

KENNAMETAL

SUPERIOR CEMENTED CARBIDES

KENNAMETAL Inc., LATROBE, PA.

How Much is .000,000,25 of an inch?



Not even a laboratory microscope could discern it! But this new machine is so sensitive to vibrations produced by unbalance that it can *feel* and *indicate* a workpiece bearing displacement as minute as one four-millionth of an inch—¼ of a micro-inch!

THE NEW GISHOLT DYNETRIC* MICRO-BALANCER

Here precision is carried to a degree never before known in the field of dynamic balancing. Here a displacement of .000,000,25" due to unbalance vibrations causes the indicating needle to move approximately one-half inch.

The Micro-Balancer was designed especially for balancing parts at any speed up to 36,000 r.p.m.

Where desired, the workpiece can be driven by its own source of power. For example, an air-driven gyro rotor can be driven by an air jet. Or a high-speed, high-frequency motor can be balanced in its own housing and running under its own normal power source.

The new Dynetric Micro-Balancer is another example of Gisholt's ability to balance any rotating part. This unquestioned leadership is at your command.

**A development of Westinghouse Research Laboratories and Industrial Electronics Division.*

THE DYNETRIC MICRO-BALANCER *is available in two basic models: Type H for locating and measuring unbalance in parts supported with rotational axis in a horizontal plane and Type V—for workpieces supported vertically. Literature on request—specify Form 1099.*

GISHOLT

GISHOLT MACHINE COMPANY

1201 East Washington Avenue • Madison 3, Wis.

Look Ahead . . . Keep Ahead . . . With Gisholt

TURRET LATHES • AUTOMATIC LATHES • BALANCING MACHINES • SPECIAL MACHINES

● This Thompson Type B 12"x24" grinds the sides and edges of articulating rods for Radial Aircraft Engines—six at a time.

The machine is equipped with automatic down feed and spark-out control which allows operator to load the rods on the fixture arbors for the next machine loading during cutting operation.

Thompson Hydraulic Operation assures a smooth flow of power to wheel head and table and results in an accurate smooth finished grind.

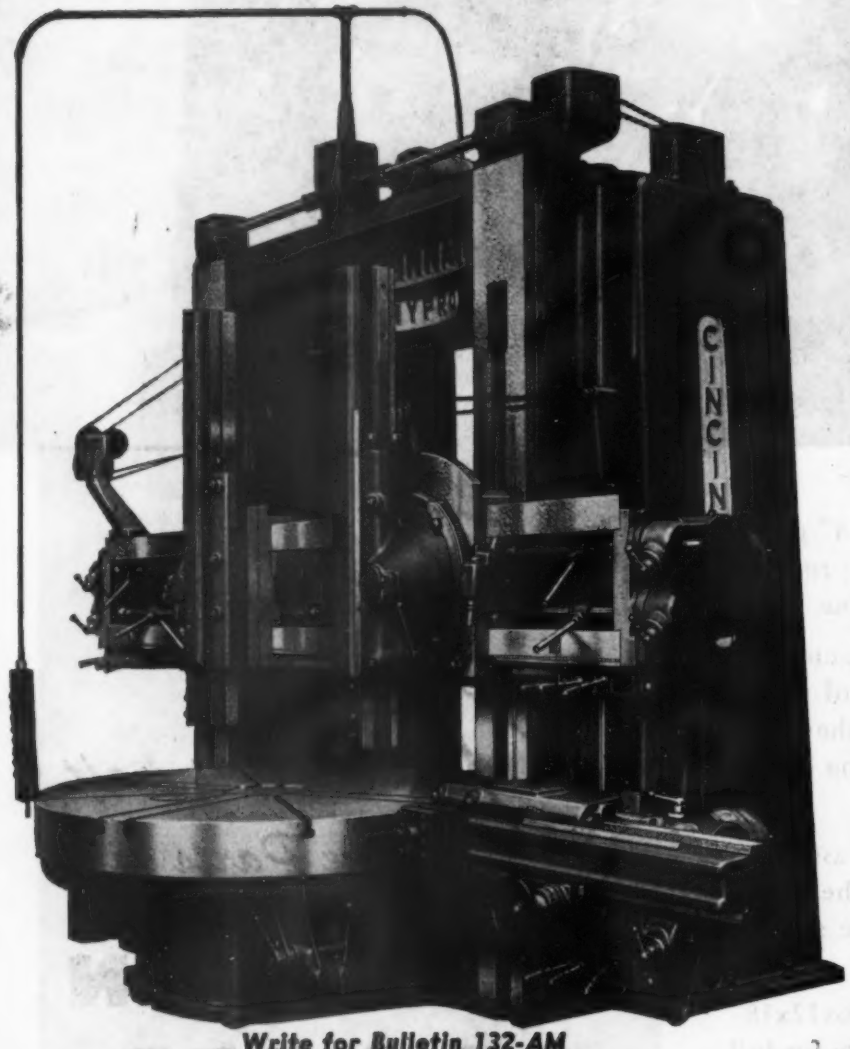
A full range of sizes and types from 6x12x18" to 36x36x240" are available. Write for full descriptive bulletin.

Grinding Radial Aircraft Engine Parts on a

THOMPSON GRINDER

THE Thompson GRINDER CO.

CINCINNATI HYPRO *7' Vertical* BORING MILL



Write for Bulletin 132-AM

For Capacity Versatility Accuracy

Specify Cincinnati Hypro Vertical Boring and Turning Mills.

The 7' Mill shown brings you these advantages:

One-piece bed and speed box, reinforced with heavy radial ribs to eliminate misalignment.

Extra depth table heavily reinforced with radial ribs and driven by a wide face spiral bevel gear that is nearly the full diameter of the table.

The table runs on anti-friction bearings.

A fully Timkenized speed box, built into the one-piece bed, offers 16 speeds on alternating current or wide range, fine increment speed adjustment with a direct current main drive motor.

Massive pyramid type housings provide for rigidity under the most severe duty.

Quick acting, self-interlocking rail clamp may be operated from either end of the extra heavy rail.

THE CINCINNATI PLANER COMPANY

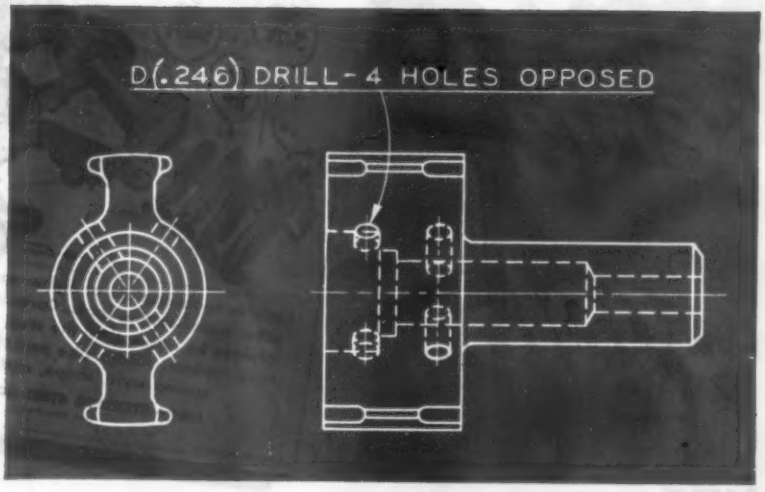
Planers...Vertical Boring Mills...Planer Type Millers

CINCINNATI . OHIO . U.S.A.

There are 2 ways to do this job—

1. The EXPENSIVE WAY . . . or

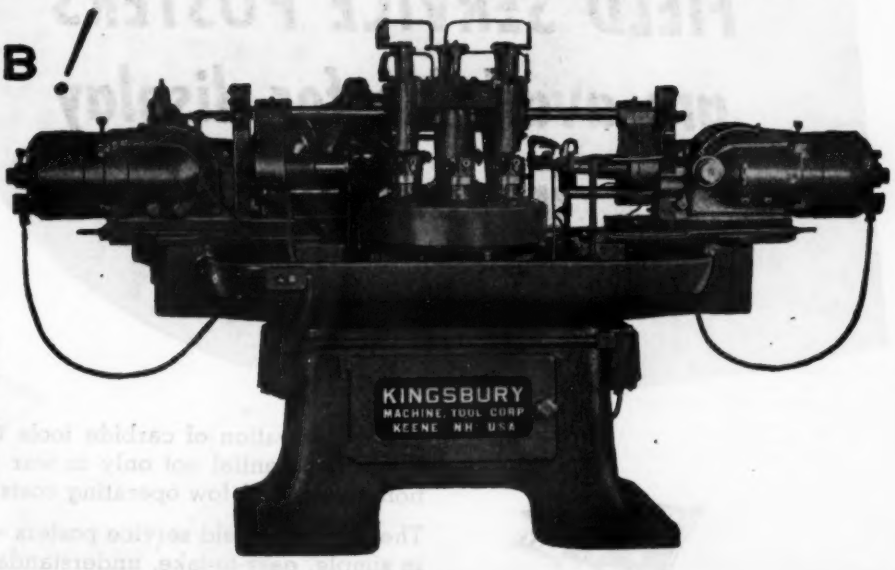
2. The FLEXIMATIC *by KINGSBURY*



WAY

The expensive way to drill the four opposed holes in this shock absorber part would be to use a general-purpose drilling machine. Production would be limited to one hole at a time and by operator skill in manual indexing, etc. The FLEXIMATIC way uses standard Units set up on a standard base around an automatically indexing turret. The only manual operations are loading and unloading, and even as these are being performed the Units are drilling work already loaded.

FLEXIMATICS combine the speed and efficiency of a special purpose machine with the valuable advantages obtained by the flexible set-up.



Standard Kingsbury Units for drilling, reaming, boring, spot facing and many milling operations may be mounted in any combination on standard bases and readily changed over to manufacture a wide variety of parts.

KINGSBURY MACHINE TOOL CORPORATION

KEENE NEW HAMPSHIRE U S A

A few simple rules to conserve carbide tools

BE SURE TO USE THE PROPER TOOL!
FOR SIZE
FOR SHAPE
FOR TIP
Carbide tools operate at higher speeds t
other metal-cutting tools. Carbide tools
always be larger than the steel or allo
they replace. Also, make sure they ar
correct style, shape, and grade.
FIRTH-STERLING STEEL COMPANY

FIRTHITE FIELD SERVICE POSTERS are available for display in your plant

The conservation of carbide tools through proper handling and correct usage is essential not only in war time but at any time for best production results and low operating costs.

These Firthite field service posters will help remind your plant operators in simple, easy-to-take, understandable manner, of the right way to make carbide tools do their utmost.

Fill in and mail the coupon for your set of these free, 17" x 22", four-color posters.

HANDLE 'EM WITH CARE!
IT'S BEST TO BABY 'EM!
Carbide tool cutting edges should be protected so that they do not come in contact with other tools or metal parts except when cutting. It is best to provide wooden, partitioned boxes for storage. Use plastic dip or tape on the tips.
FIRTH-STERLING STEEL COMPANY
SET 'EM CORRECTLY
bide tools should have just enough relief to rovide free cutting action, AND NO MORE. erwise you weaken the cutting edge. Set the cutting point exactly at the height of the centerline of work.
FIRTH-STERLING STEEL COMPANY
EEP 'EM SHARP!
OUCH!
FIRST AID
Watch your carbide tools! Don't let them cut until they break! Change them for resharpening when a reasonable number of pieces have been machined. This will give you more pieces per tool. Remember—sharp tools give better accuracy and use less power.
FIRTH-STERLING STEEL COMPANY
GRIND 'EM PROPERLY!
TOOL GRINDING RULES
Grinding rules for carbide tools are easily available and should be followed carefully. The right wheel, running in the right direction, preserving correct angles are some of the things to watch. Don't guess—grind carbide tools according to rules.
FIRTH-STERLING STEEL COMPANY
WHEN GRINDING DON'T USE TOO MUCH FORCE
HELP!
Don't exert too much pressure against the abrasive wheel when grinding carbide tools. If the wheel is right, light pressure will remove metal at a suitable rate. Too much pressure causes excessive heating and may damage the tool!
FIRTH-STERLING STEEL COMPANY

FIRTHITE

Firth-Sterling

STEEL COMPANY

FIRTH-STERLING STEEL CO., Dept. AM–McKeesport, Pa.

Please send us without obligation on our part_____sets of Firthite Field Service Posters which we wish to display in our plant shops.

NAME_____

TITLE_____

COMPANY_____

ADDRESS_____

MAKERS OF HIGH-SPEED STEELS, TOOL AND DIE STEELS, AND SINTERED CARBIDES

REED-PRENTICE

#4 Vertical Milling Machine . . . featuring

ELECTRONIC

CONTROL FOR ALL FEEDS

Master control station for spindle motor and all feeds

- Infinitely variable feeds.
- Wide range of spindle speeds with single lever control.
- All controls within convenient reach from normal working position.
- Filtered and automatic lubricating system for table and cross ways.
- Rugged construction for negative rake milling and die sinking.

• SPECIFICATIONS •

WORKING SURFACE—TABLE 24" x 84"
LONGITUDINAL TRAVEL—TABLE 48"
TRAVEL CROSS SLIDE ..... 23"
VERTICAL TRAVEL—HEAD ..... 12"
18 SPINDLE SPEEDS 30-1200 RPM
TABLE FEED—INFINITELY VARIABLE ½" to 26" per min.
CROSS SLIDE FEED—INFINITELY VARIABLE ¼" to 20" per min.
POWER DOWN FEED—INFINITELY VARIABLE ⅜" to 26"
POWER RAPID TRAVERSE TABLE ..... 180" per min.
POWER RAPID TRAVERSE CROSS SLIDE 120" per min.
NET WEIGHT ..... 20,500 lbs.

★

ARMY NAVY

MACHINE TOOLS

REED-PRENTICE CORP.

WORCESTER MASS. U.S.A.

NEW YORK OFFICE: 75 West St., New York 6, N. Y.
CLEVELAND OFFICE: 1213 W. 3rd St., Cleveland 13, Ohio

As in these plants . . .

GULF QUALITY PETROLEUM PRODUCTS

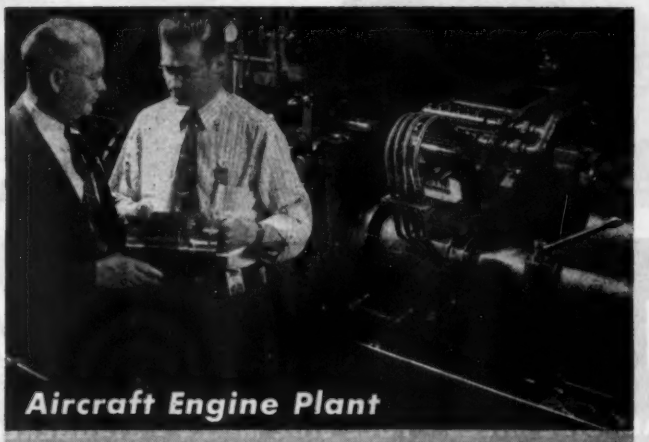
can help you increase output and reduce costs

THESE three cases are typical! Plant operating men from Maine to New Mexico report similar benefits from the use of Gulf quality products.

Have you talked with a Gulf Engineer about the possibility of making further production improvements through better selection and use of oils and greases? He is familiar with many recent developments, has had broad practical experience, and can help you cash in on the benefits that can be obtained through modern petroleum science and lubrication practice.

Gulf Cutting Oils, for example, used as recommended by Gulf Engineers, have helped step up production on the toughest metals used by the armament and aircraft industries. Many special Gulf products, developed by research before and during the war, have helped plant men make phenomenal production records on war materiel.

To reduce your maintenance costs and increase operating efficiency, call in a Gulf Service Engineer today. The Gulf line of more than 400 quality oils and greases is available to you through 1200 conveniently located warehouses in 30 states from Maine to New Mexico.



Aircraft Engine Plant

This machine fins 67% more aircraft cylinder barrels since the proper Gulf Cutting Oil replaced another cutting fluid—and tool life has been increased over 100%.

Tank Transmission Plant

By switching to Gulf Cutting Oils, this gear-hobbing department increased production and eliminated rejects due to tearing.

Coal Mine

Better lubrication with Gulf quality lubricants cleared up clutch trouble in loading machines. Result: increased tonnage, and lower maintenance costs.

GULF INDUSTRIAL LUBRICATION

Helps make machines produce more at lower cost

Gulf Oil Corporation · Gulf Refining Company

Gulf Building, Pittsburgh 30, Pa.

SAVE WITH INGERSOLL *Inserted Blade* ARBOR CUTTERS

HALF SIDE MILLS • FULL SIDE MILLS • STAGGERED TOOTH SLOTTING • CHANNELING • INTERLOCKING

INTERLOCKING

CHANNELING

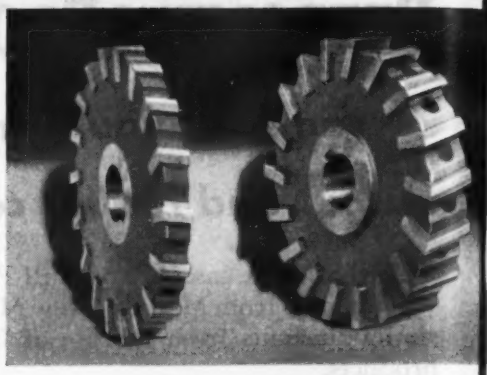
LOCK NARROW SLOTTING

FULL SIDE MILL

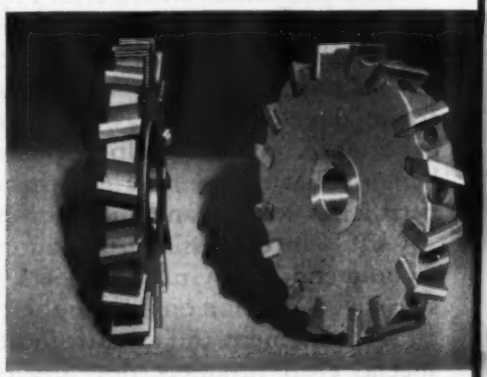
Ingersoll *inserted blade* arbor cutters are replacing solid high speed steel and solid brazed tip designs due to economy of replacement blades. It is not necessary to purchase complete new cutters, as only the *inserted blades* are perishable. The cost of a new set of blades is much less than the cost of a new solid type cutter.

There is an Ingersoll *inserted blade* cutter for all straddle milling, keyway cutting, channeling, or slotting operations requiring cutters from 4" diameter and 3/8" wide up to any size that may be required. Several different styles and types are illustrated here and each has its particular field of application. Cutters may be furnished with high speed steel, cast alloy, or carbide tipped blades, and with cutting angles suitable for cast iron, steel, aluminum, or any other non-ferrous alloy.

Ingersoll designs and manufacturers inserted blade milling and boring tools of all types. Write for Engineering Specification Sheets describing the standard face mills, arbor cutters, end mills, and helical cutters.

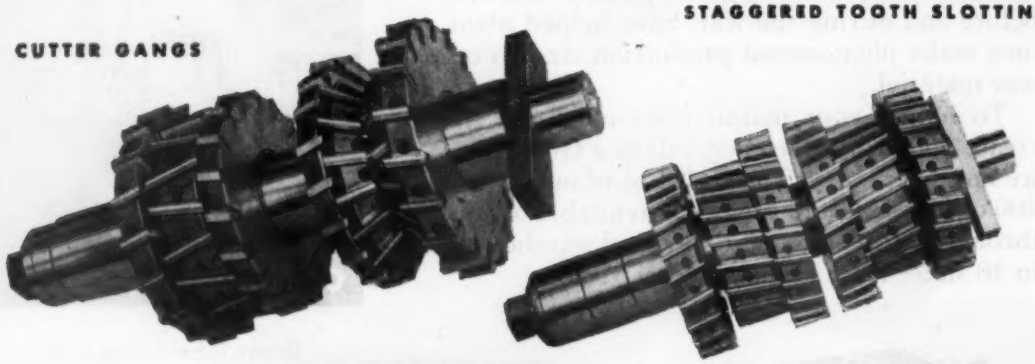


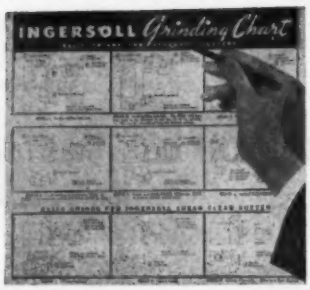
HALF SIDE MILLS



STAGGERED TOOTH SLOTTING

CUTTER GANGS





Use This
WALL CHART

Wall chart suitable for mounting in tool room illustrating proper grinds for milling cutters.

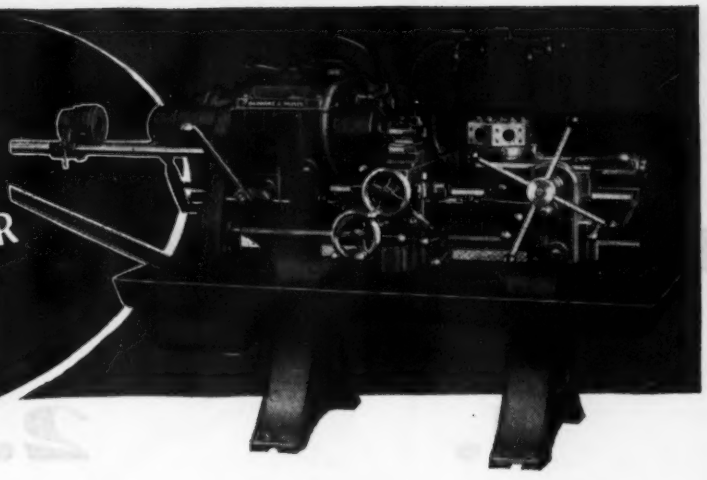
Write for
INGERSOLL CUTTER GRINDER BULLETIN

describing operation of machine and fundamental principles of good cutter grinding.

THE INGERSOLL MILLING MACHINE CO., ROCKFORD, ILL., U.S.A.

Women Enjoy Operating

THE BARDONS & OLIVER NO. 3 UNIVERSAL TURRET LATHE



because it handles so easily.

A new (effortless yet powerful) hydraulic spindle brake enhances still further its long standing reputation as the EASIEST OPERATED AND MOST SENSITIVE UNIVERSAL TURRET LATHE.

Coupled with ample power, speed, rigidity, and efficient tooling, the important feature of ease of handling makes this machine an outstanding producer of small parts from bars, forgings or castings.

BARDONS & OLIVER, INC.

1133 WEST 9TH STREET CLEVELAND 13, OHIO

LONG LIFE!

1.

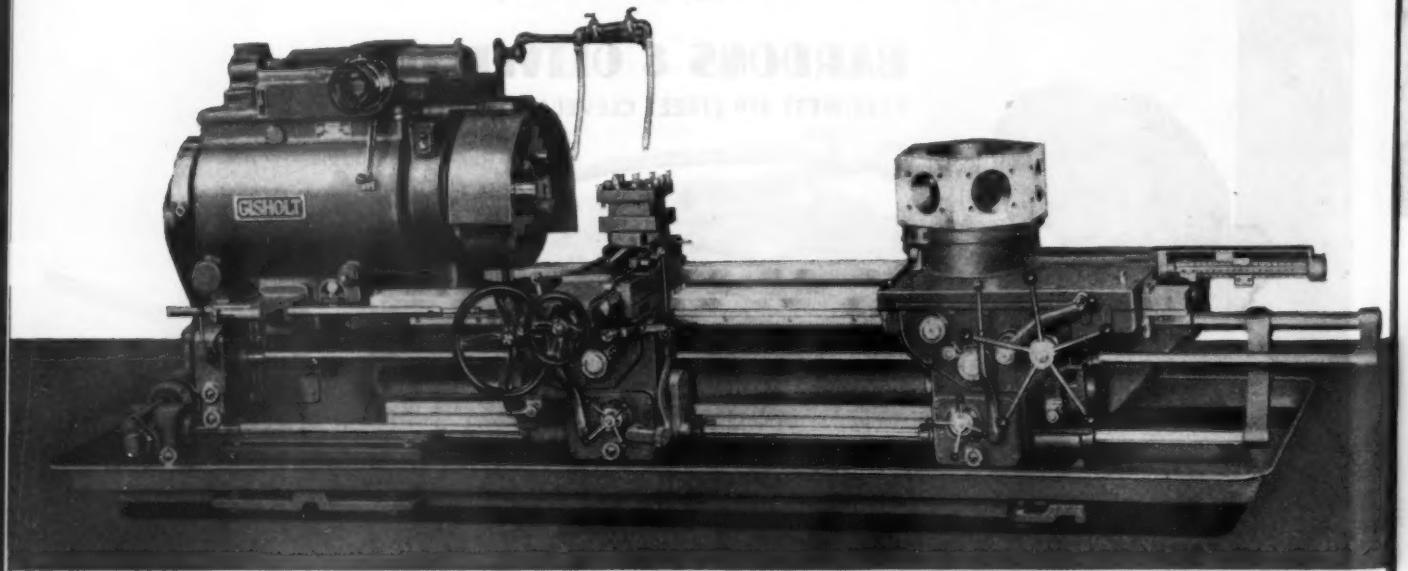
All gears in Gisholt's 12-speed transmission are high carbon alloy steel, precision ground after heat-treatment to assure long wearing quality. All shafts turn on antifriction bearings, with pressure spray lubrication. Headstock is cast integral with bed for extreme rigidity—to maintain accurate, permanent alignment.

2.

Gisholt's thick, block-type ways are automatically pressure lubricated. Made of SAE 52100 tool steel, they are deep hardened to 64-66 on the Rockwell C Scale and finish-ground in exact alignment with the spindle. On top, bottom and both sides, they present a bearing surface that is virtually wear-proof—assuring accuracy for years to come.

3.

Aprons are fully enclosed, all working parts protected and operating in a continuous cascade oil bath. Alloy steel gears and shafts are mounted on antifriction bearings. Positive serrated feed and traverse clutches cannot slip or bind. Safety shear pins protect feed and traverse mechanism against overload and accident.



● You want speed and easy operation in a turret lathe, of course. And you'll find them in these Gisholts. But you want long life, too, when you invest in a turret lathe. It means lasting accuracy, freedom from repair bills, protection for your investment for years to come. Ask for full information.

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Federals are made with exacting care in a plant devoted exclusively to the production of *fine* ball bearings. Nothing is slighted, nothing left undone, to safeguard Federal Quality. That is why manufacturers in every important industry depend upon Federals for *precision performance*. If you are now thinking about reconversion, — use Federal Ball Bearings in your machines, tools, or products.

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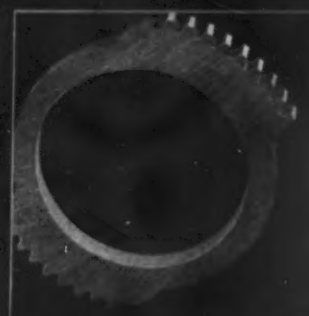
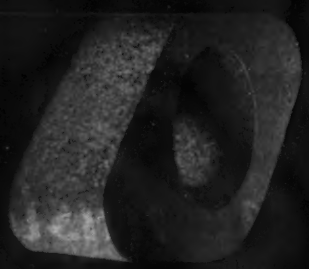


Entire contour including teeth surface broached.

Deep slot broached in steel.

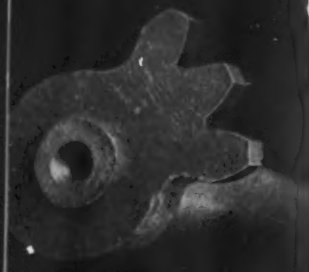


Flat surfaces broached on cast iron.

Copper contactor surface broached.

Wide Variety

OF MACHINE OPERATIONS



Worm sector broached.

Form broaching.

Bevel gear rough broached.

Straddle surface broaching.

Serrations surface broached.

"Tee" slot surface broached.

★ Keen competition in forthcoming days will require the high production machining rates that are possible with surface broaching. The few parts illustrated will give you some idea of the variety of copper, cast iron and steel parts that are broached fast, accurately and with a low tool maintenance cost. In hundreds of plants there are many parts being produced that can be more economically made by taking advantage of this high production machining method. Send your prints and hourly production required for our recommendations.

THE FOOTE-BURT COMPANY
CLEVELAND 8, OHIO
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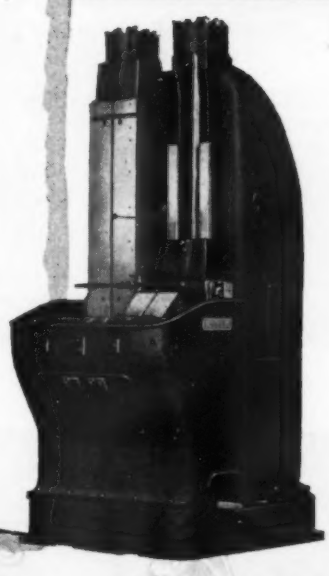
MOVE UP THE SCHEDULE ☆ WIN THE WAR QUICKER

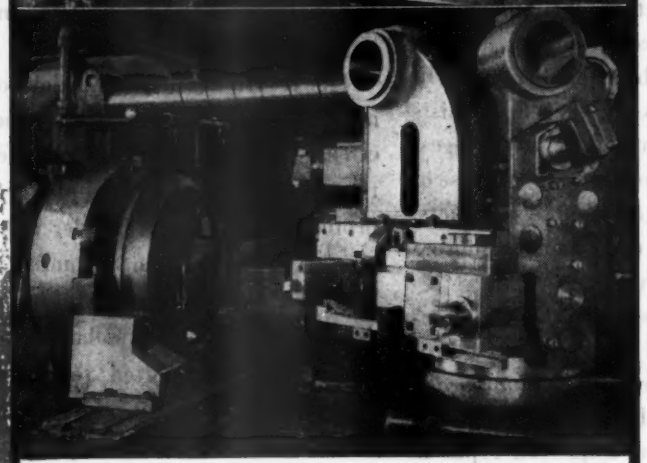


Footburt Patented Tooth F

FOOTBURT Surface Broaching

JUN

Include P&J RE-TOOLING IN YOUR PLANS FOR RECONVERSION.....



Production men recognize the importance of being able to consummate their post-war plans quickly in spite of the fact that many new machine tools may not be available when they are most urgently needed.

One answer to this problem of reconversion lies in ability to change over present equipment quickly to handle work other than that for which the original tooling was designed. The tooling set-up on the 8 DXT P & J Automatic for example, for machining flywheels, can be readily changed to make this machine a valuable cost-cutter in the production of other parts.

Owners of P & J Chucking Equipment are, therefore, in an advantageous position because, with P & J machines, re-tooling is practical and profitable and can be worked out in advance of immediate requirements with full assurance that the manufactured parts will be produced at lowest cost.

You are urged to consult with P & J engineers now on your post-war plans and thereby simplify your reconversion problems.

P & J REBUILDING SERVICE

Owners of P & J Equipment should investigate P & J shop facilities for restoring present machines to original accuracy and productivity through rebuilding. A convenient time for re-tooling is available when machines are in our shop for rebuilding.

POTTER & JOHNSTON MACHINE CO.

PAWTUCKET, R. I.

THE EXTRA BONDS YOU BUY ARE THE ONES THAT COUNT

Specialized CORROSION PREVENTIVES

. . . modern chemical compounds made possible by Quaker-developed advanced testing techniques:

QUAKER FERROCOTES

Quaker-developed "Dry-Type" Humidity Cabinet . . . one of 10 separate tests used in Quaker's Research Laboratory.

• To DEVELOP specific compounds of known ability to prevent corrosion under specific conditions of use . . . that is and has been Quaker's aim. In this work Quaker research chemists enjoy two tremendous advantages:

1. Not being restricted to the use of petroleum derivatives or by-products, they are free to draw from *all* sources of organic chemicals.

2. Having discarded most conventional methods of evaluating corrosion preventives as *too inaccurate*, Quaker research chemists have developed new and improved types of humidity cabinets and testing techniques.* These make possible accelerated laboratory tests that tie in with the many and varied conditions met in actual use.

The result has been the development of more than a score of FERROCOTES—*specialized* corrosion preventives each having a proved ability to protect precision parts under a specific set of environmental conditions.

A Quaker Process Engineer will gladly specify the particular FERROCOTES especially suited to protect your products . . . during processing . . . while in storage in your plant . . . during inter-plant shipment . . . and for final packaging.

***Details of these will be sent on request to interested readers.)**

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That's Right, My Lad —PLAY SAFE!

ARBORS not in use should be stored in a rack, suspended by the flange, as shown above.

This young catcher has the right idea. He wears a mask behind the bat. He doesn't believe in taking any unnecessary chances.

Many a shop foreman . . . or superintendent, for that matter . . . could learn a lesson from this cautious youngster. For often a shop executive has to "take-it-on-the-chin" when vital production schedules are disrupted.

For example, when a milling machine arbor breaks down, production ceases instantly. Both machine and operator become idle, and their supervisor is in a dilemma . . . UNLESS a spare arbor is immediately available.

So play safe! Keep several spare arbors on hand for emergencies. Remember, arbors are classed as "perishable tools" and their cost today is relatively small.

Kempsmith Arbors in all popular sizes and types are regularly carried in stock. Every one is a precision-built tool, adaptable to ANY make of milling machine equipped with standardized spindle. Fill-in and mail coupon for copy of Kempsmith Arbor Bulletin No. 116.

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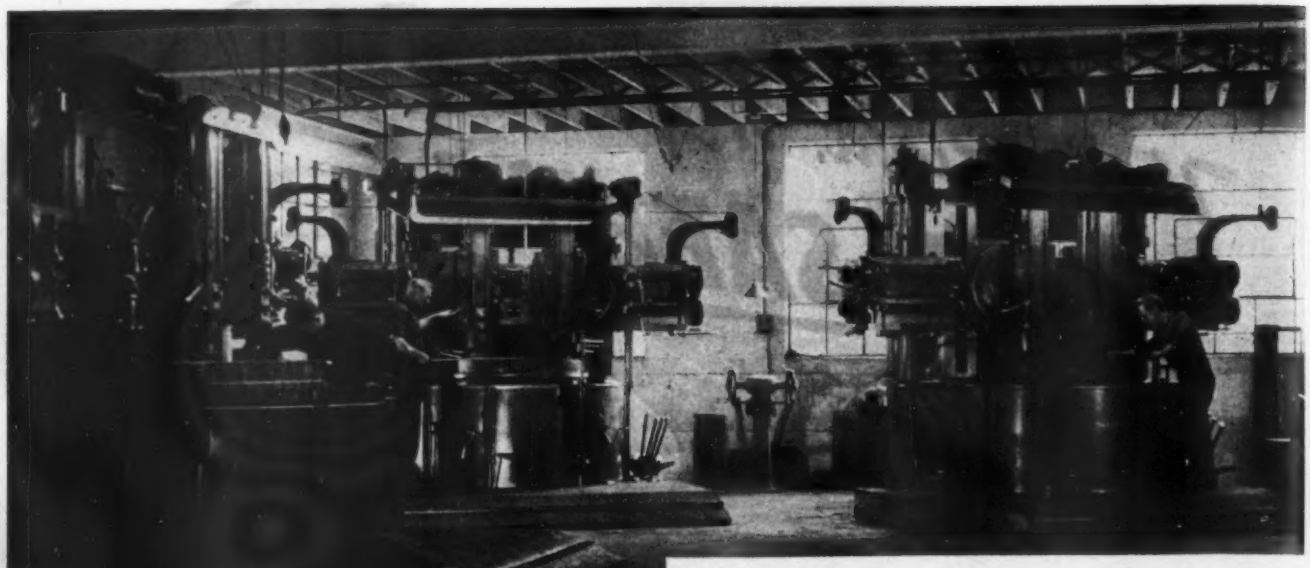

This battery of

KING

VERTICAL BORING & TURNING MACHINES

makes this a highly productive corner

● The battery of KING Vertical Boring and Turning machines shown enables this company to handle economically, a wide range of turning—boring—and facing operations easily—quickly—accurately.

Here is a group of machines having ample power and speed to handle carbide and similar alloy steel tools for turning steel—semi-steel or soft iron castings with equal ease. They also have the rigidity essential to the production of precision work and the stamina to take heavy production demands 24 hours a day.

If your work involves turning—boring—facing or similar operations—put it on a King for speed—accuracy—and ultimate economy.

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***KING BUILDS** Vertical Boring and Turning Machines exclusively—single column types from 30" to 42"—double column types from 52" to 12 feet.*

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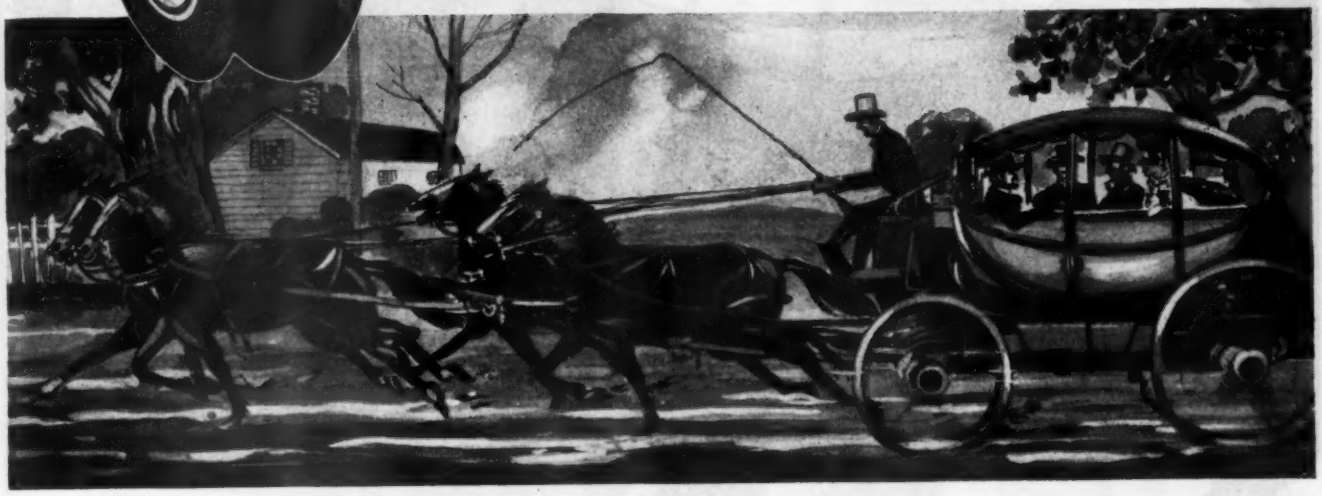
BUILDERS OF VERTICAL BORING AND TURNING MACHINES EXCLUSIVELY

Setting the PACE!



• In frontier days, before steel rails spanned the western plains, the fast coach set the pace in rough and ready transportation for the venture-some traveler.

Today, the Mid-West Abrasive Company sets the pace for high-quality, dependable abrasive products of all classifications. The broad Mid-West line includes sandpapers, grinding wheels, honing stones, sharpening stones, wheel dressers and abrasive specialties.

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PISTOL GRIP TYPE

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CHECK THESE ADVANTAGES:

- *Reduced overall length.* The No. 210G is now 5¾", as compared to 7¾" before . . . More compact and sturdier . . . The perfect tool for a full range of drilling uses.
- *Handle locks rigidly* to gear case and provides positive protection against accidental loosening of threaded housing parts.
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- *Powerful new-type rotor* of THOR one-piece construction rotates on precision ball bearings. Long, smooth-running, trouble-free operation is assured.
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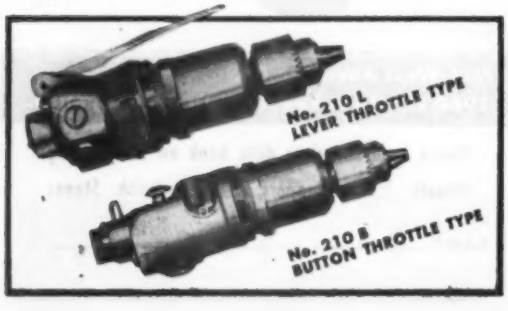

Here's more drill in less space with less weight. Better balanced for greater efficiency. This new THOR air drill is compact, sturdy . . . a "honey to handle." Finds many uses in aircraft assembly—particularly drilling in channel sections, skins, contours, spars, wings and fuselage where limited space bars larger drills. Production line men are quick to spot the improved design, balance and easier handling that mean less fatigue . . . more and better work.

THOR tools that today help to keep production lines rolling will later serve the peacetime needs of the nation. For every material or operating condition, there is a THOR portable tool—pneumatic or electric—that is available in a full range of sizes, speeds, torques and capacities.

Thor PORTABLE *Electric & Pneumatic* TOOLS

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• *Photo: Courtesy of Taylor-Wilson Mfg. Co., McKees Rocks, Pa.*

The Cincinnati Bickford Feed Clutch is positive in action, engages instantly, and is controlled with finger-tip touch. Proper proportion and advanced design give the operator a practically effortless and instant control of the tool.

Equal Efficiency of Every Unit Makes the Balanced Machine

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We quote from The Taylor Wilson Manufacturing Company:

1 "... during this rush period, the Super Service Radial Drill not only reduced drilling costs 30%, but, enabled us to do considerable boring work at low cost.

2 Better work for longer hours was effected through the ease with which operators handled the machine.

3 Rigidity and lack of spring in the column greatly prolonged drill life."

Write for detailed Bulletin R-24 A

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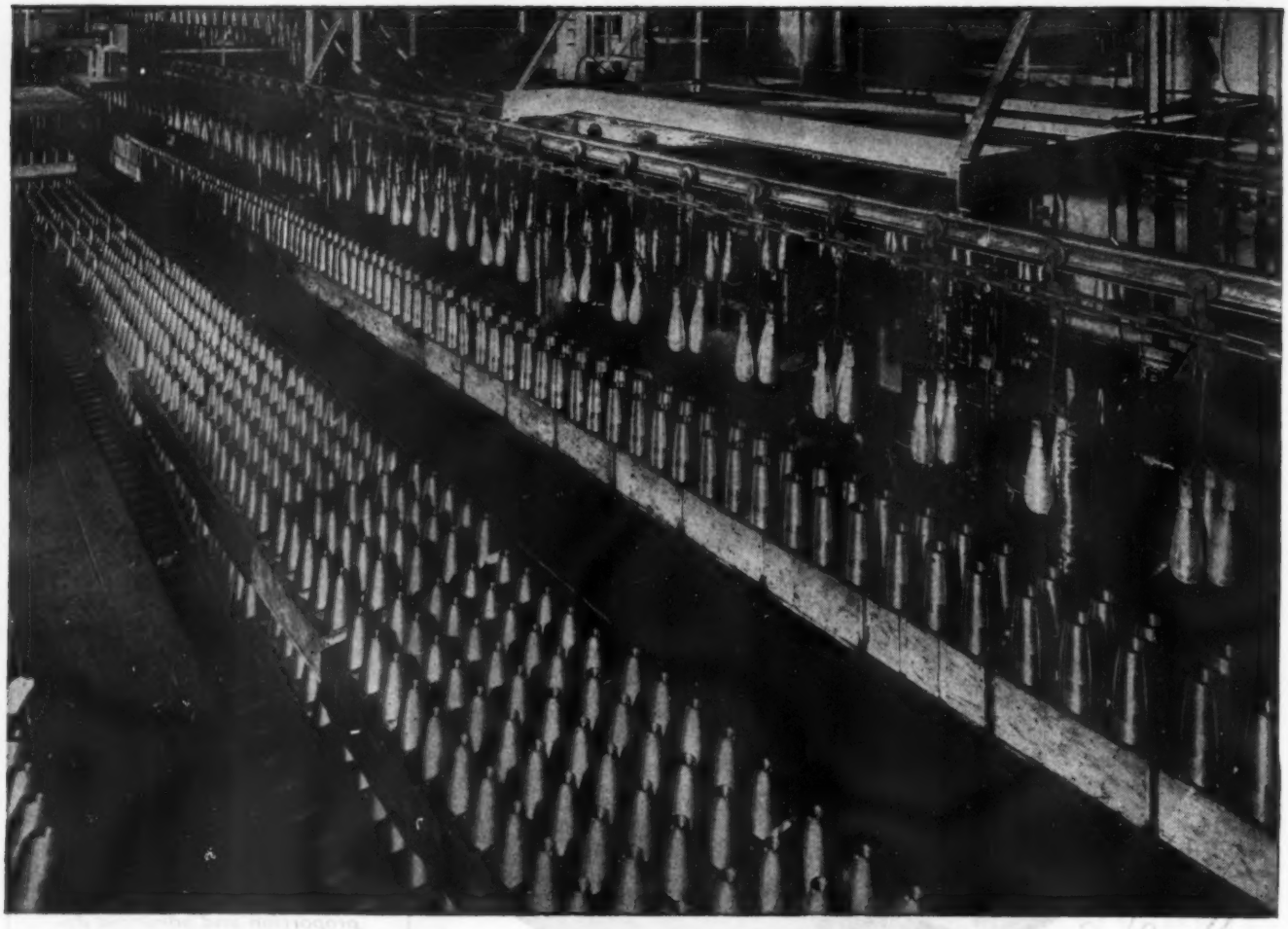
THE CINCINNATI BICKFORD TOOL CO. Cincinnati 9, Ohio U.S.A.



MORE SHELLS PER *TOOL GRIND*

ACCURACY and speed — both are "musts" in machining shells. Consequently, cutting tools must stay sharp, down time for changing tools must be kept to a minimum. Best way to do this is by the proper selection and application of the most suitable cutting fluids.

Texaco Cutting and Soluble Oils will definitely help you to get more production per tool grind, regardless of the type of machining or the metal being worked. These fine cutting fluids cool and lubricate the tools, carry away heat, prevent chip welding — thus prolonging tool life, assuring greater output.

Faster machining and better finish are two other advantages you can count on when you use Texaco Cutting and Soluble Oils — additional reasons why experienced machine tool operators everywhere prefer Texaco.

The services of a Texaco Engineer, thoroughly qualified to assist you in the selection and proper application of cutting coolants for your particular machining requirements, are available through more than 2300 Texaco distributing plants in the 48 States.

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FREE! This 40-page booklet explains the *why, where, when* and *what* of cutting fluids. Contains many practical suggestions and recommendations to help you improve the speed and quality of your machining. Send for your copy *today!*

TEXACO

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TUNE IN THE TEXACO STAR THEATRE WITH JAMES MELTON EVERY SUNDAY NIGHT — CBS

Surplus Machine Tools

THOUGH A NUMBER of government agencies profess concern over the government-owned surplus machine tool problem, and even though a sympathetic Senate committee has taken a hand in the proceedings, an extraordinary amount of confusion continues to exist.

Study of the problem in this country, plus knowledge of the plan now in effect in Britain, leads to certain broad conclusions that should aid in dissipating the current confusion.

For one thing, it is impossible to tackle the problem intelligently without knowing how many machines the government owns, what they are, where they are and what they are capable of doing. As of today, no count of that kind has been made.

Moreover, it is not possible to proceed even after gathering this information until the Army, Navy, Air Force and Maritime Commission make up their minds what machines they intend to retain after the war and what machines they will declare surplus.

Then comes the disposal task itself; and here too there is general agreement upon certain principles.

Surplus machine tools built during the war are a national asset. So long as they are idle or in storage, they are of no value. Only when put to work do they constitute a part of our national wealth. Hence they should be made available quickly to all classes of users.

Speedy disposal bespeaks the use of all legitimate sales channels, not limitation to one only. The Reconstruction Finance Corporation is the officially designated government sales agency and is well set up to do a good job of direct selling. It could supplement its own efforts by permitting discounts or commissions to legitimate dealers and to builders who would rebuild machines for customers. An arrangement of that kind is part of the British plan.

Britain employs another device that might profitably be adopted here. Contractors are offered special inducements to buy the government-owned machine tools in their plants. Such sales eliminate the transporting of tools from one factory to another, and the equipment remains in the hands of those familiar with its performance.

Still another British scheme that commends itself to our attention is a liberal scrapping policy. Britain realizes the value to her economy of junking aged, obsolete machine tools and substituting newer models.

Over here we might with profit allow a discount to a purchaser of surplus machine tools built within the last five years if he agrees to scrap completely the older machines that he is replacing.

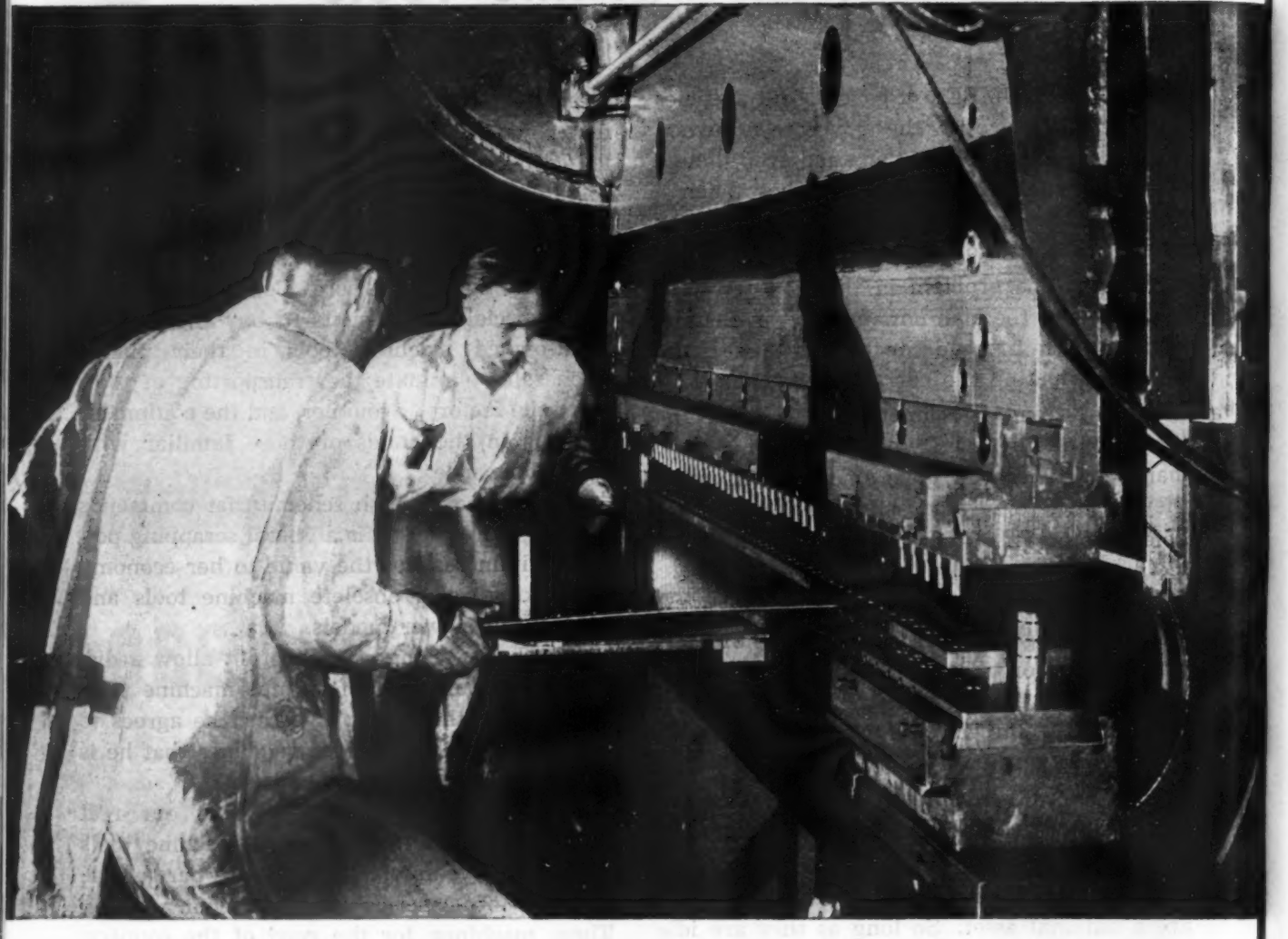
Too few people understand that our real surplus problem is the 700,000 machine tools over fifteen years old that still are part of the facilities of America's metal-working shops. These machines, for the good of the country, should be broken up under the hammer and fed into cupolas.

"There is no place left in our economy for those old machine tools," declares W. P. Kirk, vice president of the Pratt & Whitney Division of the Niles-Bement-Pond Company. "The sensible procedure is one of scrapping those worn-out and obsolete 'clunkers' that represent a high-cost hazard in the postwar period."

Burnham Finney

Punch it...

on a CINCINNATI PRESS BRAKE



Gang punching, as well as a great variety of forming, notching, combination notching and forming, trimming and punching . . . all are being done on Cincinnati Press Brakes.

Write for Catalog B-2, illustrating the possibilities of a Cincinnati Press Brake in your shop. Consult our Engineering Department on your punching and forming problems.

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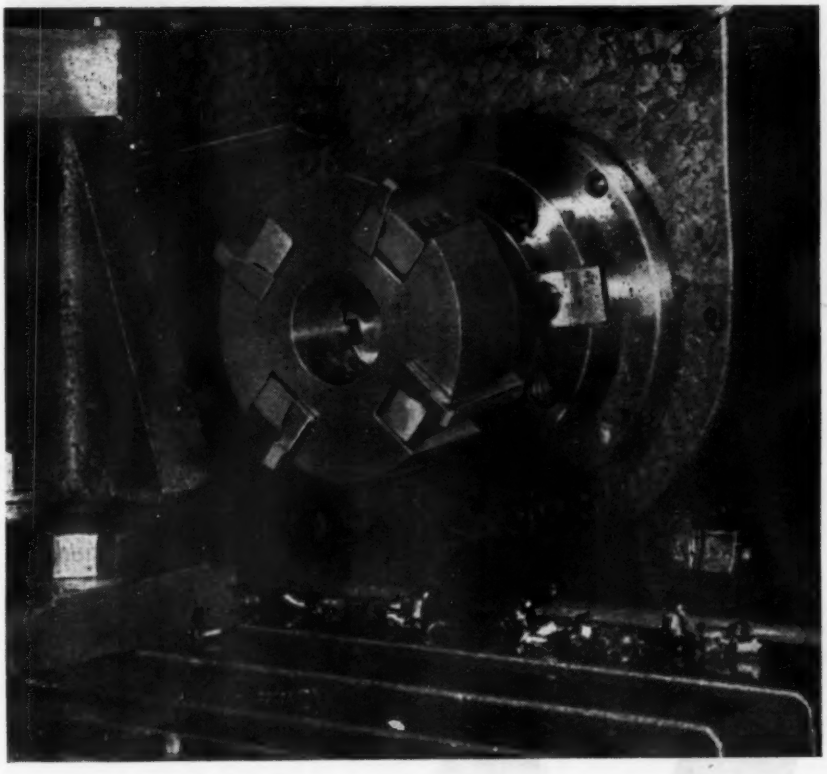
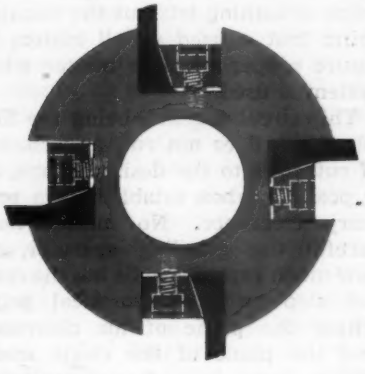


Cutter blades are clamped in the cutter body by wedge blocks. The back of the blade is a smooth plane; no serrations or other interlocking holding angles are employed. This feature permits the blade to be manufactured easily without special forming or grinding equipment for grip surfaces. The cutter can be used as a right-hand or left-hand cutter by reversing the blades and the wedge blocks in the cutter body



Improved Milling System Decreases Cutter Inventories and Costs

BY ARTHUR A. SCHWARTZ,
CHIEF TOOL RESEARCH ENGINEER, BELL AIRCRAFT CORPORATION

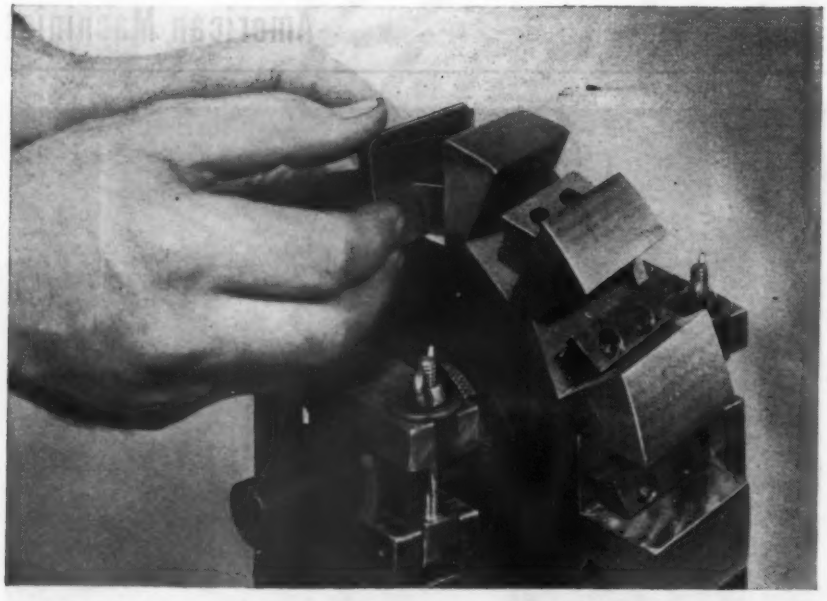
MILLING CUTTERS made of a solid piece of high-speed steel with as many teeth on them as can be found room for on the periphery are really modified saws and are operated as such, and the thinner bodied cutters are frankly called slitting saws. All mechanics are familiar with the crunching noise of the milling machines where a few teeth do all the cutting and the rest either miss the work entirely or just rub and create heat in the piece without doing any work. Much cutting oil or so-called coolant is used to make the useless teeth slide easier and thus create less heat.

The concept of a good milling cutter and milling practice in general has changed in the last few years. Cast bodies with few teeth brazed in or, in a few cases, clamped in, have attracted much attention.

Interchangeability of elements and basic simplicity are the means of attaining increases in over-all efficiency permitted by the use of this new system

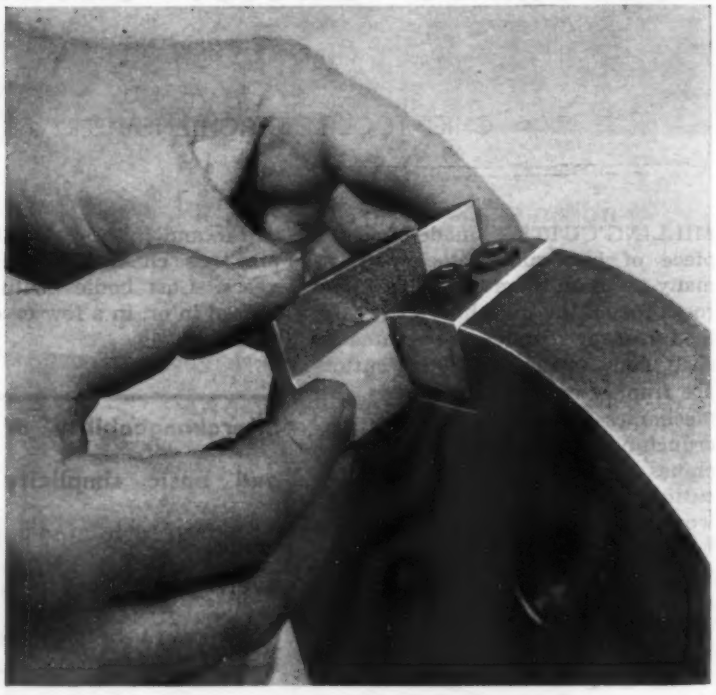
It has been demonstrated that cutters with less than eight teeth, and in many instances two teeth or even one tooth, perform the work better and faster than the old saw type of cutter. The surprising thing is that these cutters with less teeth give longer runs between grinds than do the more generously toothed cutters.

This innovation in the design of these cutters has been readily accepted and has proved its design correctness thoroughly. So this point need not be discussed further, except to note its usefulness in the grinding and cutter body types of



Cutter blades are set in the grinding body at an angle to a line normal to the edge tangent. The angle is determined by the cutter clearance angle desired. Since all slots in the grinder body are exactly alike, all blades ground in the body are fully interchangeable

The grinder body used to insure uniformity of locating side edges is mounted between centers on the blade grinder. The edge is ground to conform to optical comparator diagrams. This assures that all blades will maintain equivalent locations when mounted against the blade edge stop of the cutter body



After grinding in the grinder bodies, the blades are fully formed and are inserted in the cutter body. No further grinding or other finishing operations are required to match the blades in sets. The blade seats on the base of the slot and contacts the side stop, thus assuring related locations of all inserted blades

the much improved milling system.

The improved milling system concerns itself principally with eliminating at least 80 percent of the time spent in sharpening milling cutters. An effort has been made to simplify the method of grinding cutters so that the meticulous part of grinding lands and clearances on each individual tooth separately should be entirely eliminated.

One Operation Finishes Blades

Whenever a grinding wheel performs a certain operation, it loses some of its diameter and, when grinding a cutter by the old method, each succeeding tooth will be higher than the previously ground teeth because of this depreciation. For that reason, it is necessary, at least on the primary land, to repeat the operation over and over again until assured of nearly the same radius on each tooth. All this is eliminated in this method of grinding. In fact, there is nothing left but the circular grind that is used on all cutters to assure proper form no matter what system is used.

This circular grind, being the finish grind, does not run any chance of cutting into the desired shape, as is possible when establishing a primary clearance. No matter how careful the grinding operator, or how much experience he has, he cannot stop on the theoretical point where the plane of his clearance and the plane of the circle meet. Either there is a detrimental circular land left to cause undue fric-

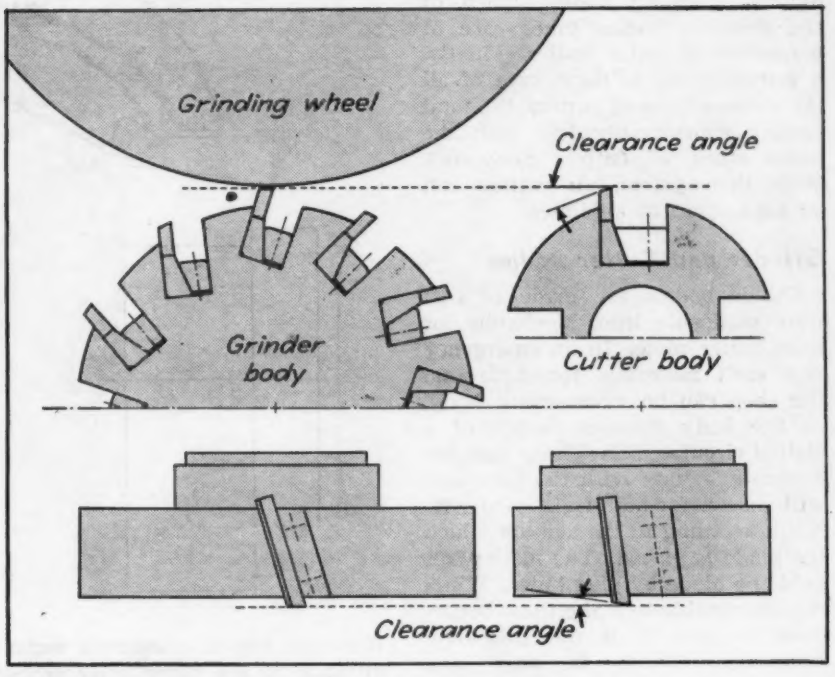
tion or some of the diameter of the cutter is ground away by the clearance angle over-lapping the circular grinding.

In the improved method, where the circular grind automatically produces this clearance, the skill of the operator is replaced by a design that eliminates hazardous operations.

Furthermore, instead of grinding two, four, eight, or more teeth per cutter as is now the practice, it is

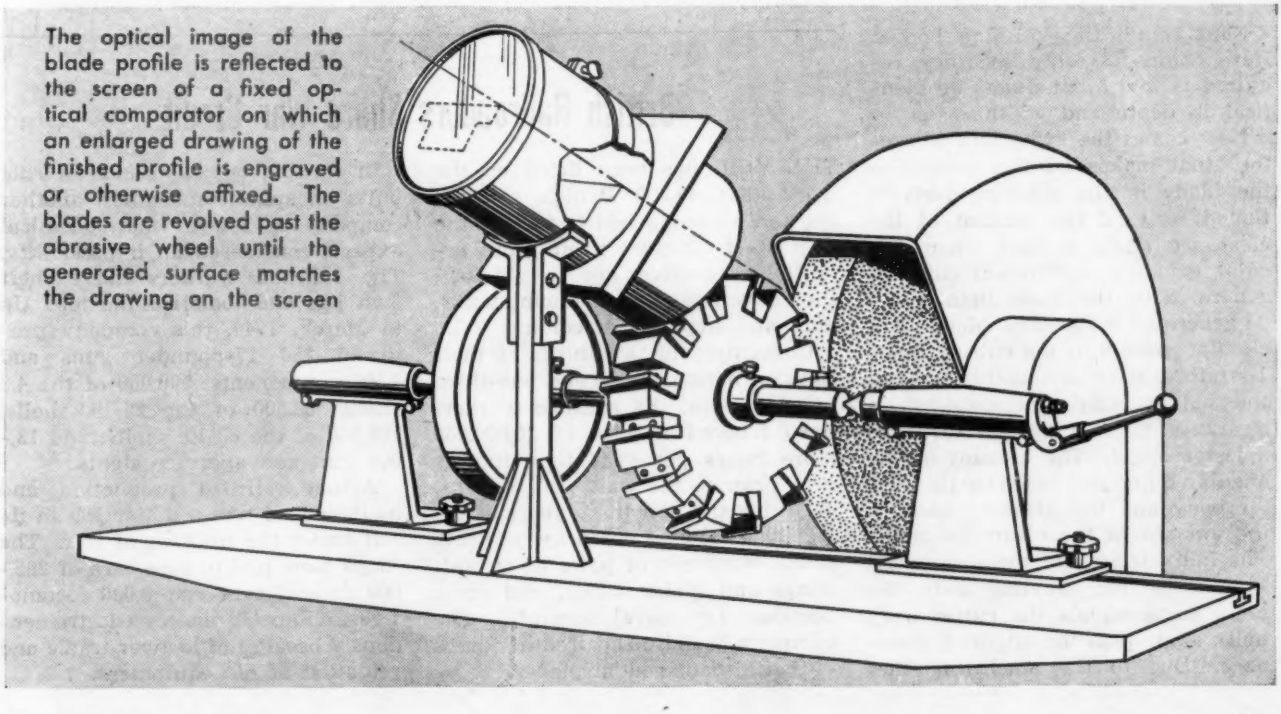
All Blades Are Identical

possible to grind from twelve blades per grind upwards to twenty-four or even more. The blades are automatically ground to identical shape. When the cutter body receives these pre-ground identical blades, all of the group assume identical positions in the identical slots of the cutter body. Therefore, when the blades have dulled and must be replaced with sharp ones, there is no necessity of removing the cutter. A simple holding cap screw and set screw clamping arrangement is loosened to permit the old blade to slide out and the new sharp and identical blades slide in. By having these blades identical with the dull blades replaced there is no need to even check the milling operation as there has been no dimensional change in the cutter or the cut it makes. It eliminates the set-up usually required in changing cutters. The time consumed in resetting the cutter and correcting the depth or other adjustments of the milling can be devoted to actual milling.



The clearance angle is generated by mounting the blade in the grinder body at a greater angle to the tangent than that of the cutter body slot. When the blade is ground in the grinder body and transferred to its position in the cutter body, the difference between the angle of setting in the grinding body and that in the cutter body is the angle of clearance

This system consists of a number of sizes and shapes of cutter bodies consisting of slab mills, face mills, adjustable slotters, and angular cutters. The use of these bodies can be changed by simply changing the grinder body types used for the grinding of the blades, so that instead of hundreds of old type milling cutters hanging on their pegs in the toolroom, one-quarter or less of the bodies will be able to do much more work. For each series of cutters, for the series of slab mills, or the series of slotting cutters, we have also one body for side location and one



The optical image of the blade profile is reflected to the screen of a fixed optical comparator on which an enlarged drawing of the finished profile is engraved or otherwise affixed. The blades are revolved past the abrasive wheel until the generated surface matches the drawing on the screen

or two grinding bodies. Each of the grinding bodies takes care of a number of cutter bodies. Finally, a grinding fixture takes care of all the various types of cutters, the total costing considerably less than the usual stock of cutters now cost. With this system, all cutters can be kept sharp at all times.

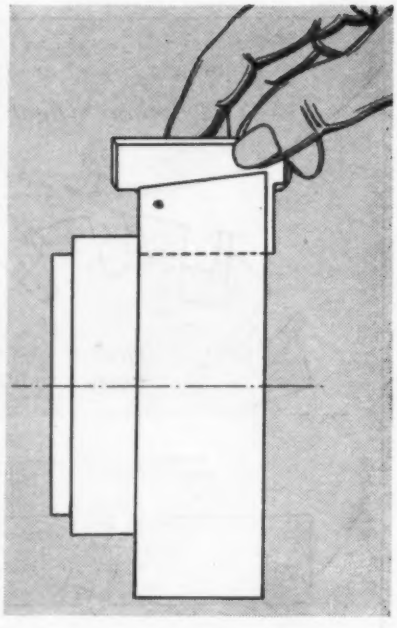
Grinder and Cutter Bodies

Cutter bodies are made of cast iron, malleable iron, Meehanite, or even boiler plate. In an emergency any such materials found around the shop can be made into a body, as the body consists simply of a slotted circular disk. These slots are generally square with the face, and will answer for both right- and left-hand, acording to the side on which the blade is placed. The filler plugs hold the blade by plug holes. While it is reasonable to make these bodies close to size, it is not primarily necessary. There is only one requisite to make these bodies work as they should and that involves cutting the slots at one setting of the milling machine and its cutter. The slots must be alike. The width of the slots can vary one or two thousandths or more without affecting in any way the accuracy or performance of this cutter.

Bodies are generally made with four slots at 90 deg. or roughly so. Such a body can be fitted with four blades, two blades, or in some cases with one blade. Larger diameter cutters which travel slowly can have more slots if required, but in all cases blades are to be kept to the minimum rather than to the maximum.

Next comes the grinding bodies. Here again the only accuracy required is that all the slots be identical in depth and width.

Now comes the "why and wherefor" that makes all this possible—the blade in the grinding body is tipped forward the amount of the clearance angle so that when circular grinding, a different curve is generated on the blade than would be generated if the same blade were circular ground in the cutting body. Therefore, as we mount this blade in the cutter body, we establish a clearance by moving the blade to a lesser angle. The amount of the angular difference between the cutter body and the grinding body is the amount of the clearance angle. The helix is treated the same way. That is, in the grinding body, the helix angle equals the cutter body helix angle plus the angle of clearance. Due to the much smoother



The edge stop is a separate section attached to the cutter body proper to establish a common plane for the lateral positioning of the blades. All blades ground to the same edge base will thus assume equivalent lateral positions in the cutter body

grind obtainable and to the fact that there are no sharp corners between reliefs, the cutter will clear itself much more readily than the old type of cutter in sticky materials such as copper, dural, and other similar material.

To further simplify grinding, the grinding fixture, consisting of an arbor driven by a small motor, takes care of the revolution of the cutter and allows the use of broadface grinding wheels of almost any kind and description. On the preferred grinding machine these wheels are mounted in pairs so that one can be used for rough and one for fine finishing without changing the setting of the machine.

The grinding fixture has an optical viewing device which shows the cutter actually viewed against a drawing on a glass templet, so that during the entire process of grinding the operator sees the actual grind of the cutter magnified greatly. This chart shows by inherent lines whether a cutter is vertical to the axis of the arbor, or whether the face of the cutter is parallel to the axis of the cutter. It also reads in thousandths to the actual diameter of the cutter. Charts for this cutter are produced by making an over-sized drawing, 31¼ × actual size, or 62½ × actual size, that is photographed to produce accurate charts on glass for mounting in the grinding microscope. This insures accuracy in cutter dimensions and at the same time eliminates tedious operations. A slight irregularity in either drawing or grinding will be so magnified that it can be guarded against.

The blades used in this cutter can be made of any cutting material; high-speed steel, Stellite or carbides; they can be brazed to the blades without any further preparation. Grinding carbides for this system is nearly as simple as grinding high-speed steel.

British Railroaders Share War Credit

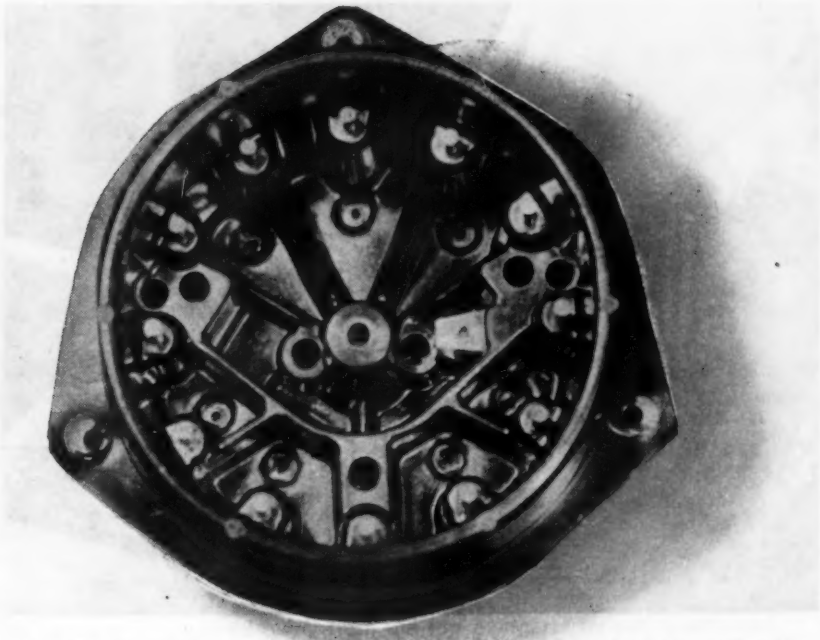
THE VEIL has been lifted on the work that 44,000 British railroad workers accomplished to further the war effort. Besides turning out essential locomotives and freight cars, they have joined in producing tanks, guns and airplanes in volume.

Concentrating two-thirds of their time on normal work and one-third on war work, the railroad workers have labored a total of 20,000,000 more hours per year than in any year prior to the war.

During the first three years of the war, one railroad company built 642 tanks, hundreds of pairs of aircraft wings and glider wings, and spare sections for naval aircraft. The company has also repaired hundreds of battle-damaged airplanes.

In turning out thousands of rifle butts on spindle machines, another company achieved what technical experts considered an impossibility. The railroad workers made their own jigs and tools for the job. Up to March, 1944, this company produced 250 17-pounder guns and 4,500 components; 500,000 of the 4.2 shells; 88,500 of the 25-lb. shells; 166,000 of the 60-lb. shells; and 13,000 gun and aperture sights.

Actual railroad production and maintenance was a major job in itself under the impetus of war. The shops have had to take care of 295,000 freight cars and 8,000 locomotives. Repairs increased tremendously because of heavier traffic and retention of old equipment.



Transfer Molding

INCREASES USES FOR

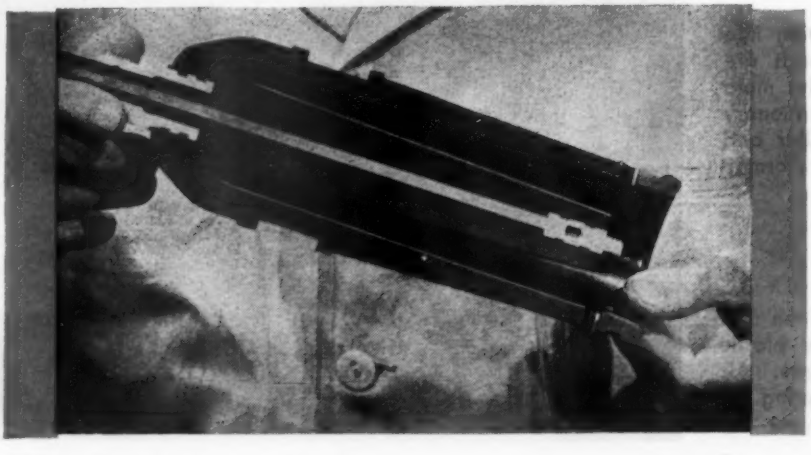
THERMOSETTING PLASTICS

Transfer molding makes possible the production of exceptionally complicated forms that are impossible to hold to close tolerances by other methods. Large numbers of inserts of intricate shapes can be accurately positioned and molded into complex plastic articles

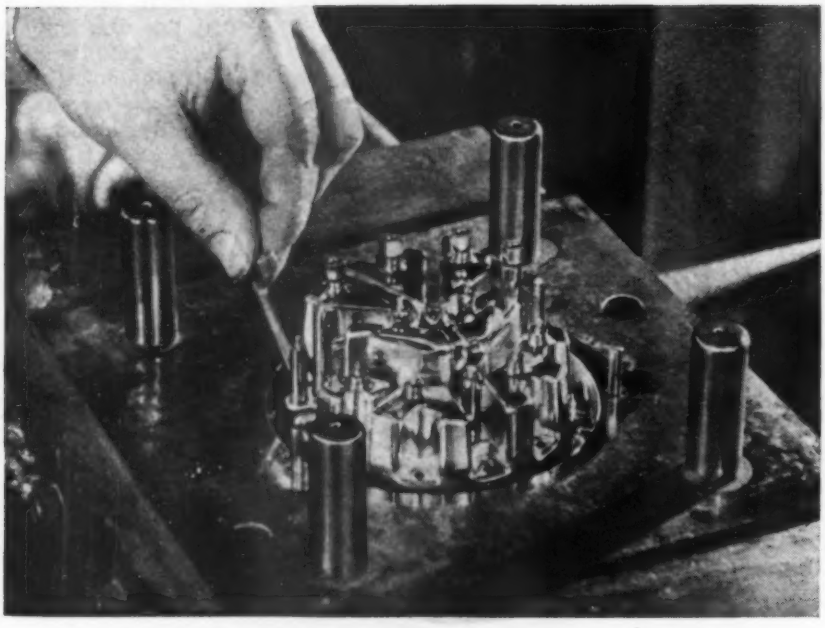
BY D. M. BUCHANAN,
CHIEF DEVELOPMENT ENGINEER, THE BAKELITE CORPORATION

Molding by the transfer method permits the application of the thermosetting materials to many constructions that cannot be molded by compression methods discussed in the first article on molding plastic materials

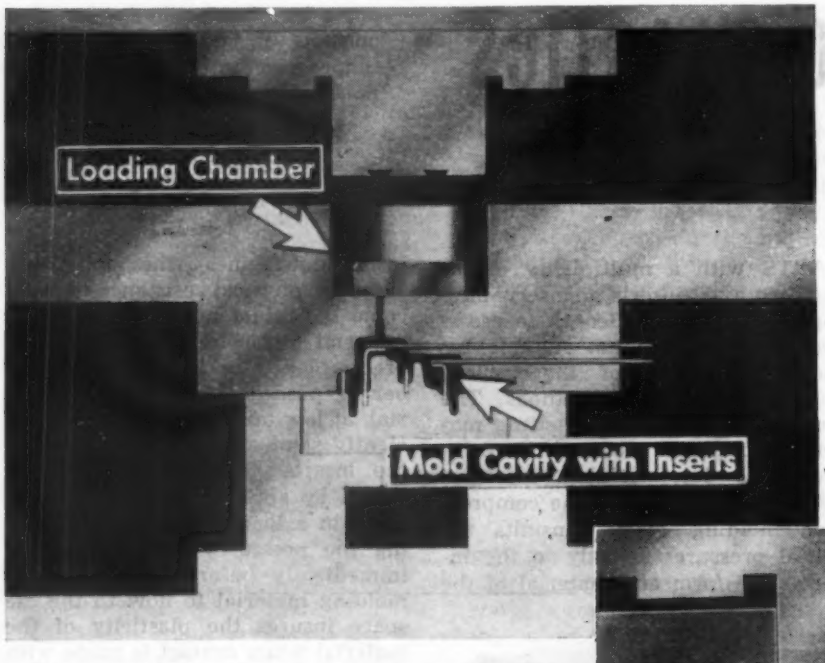
PARTS with a multiplicity of inserts, co-axial inserts or inserts having a high ratio of length to cross-sectional area are not suitable for molding by any of the various compression molding methods. The resistance of the thermosetitng materials to plastic flow at the comparatively low yielding pressures evident at the start of the compression molding cycle transmits the initial pressures directly to the inserts. The form and material of the insert determines whether it has sufficient physical resistance to overcome the reluctance of the molding material to flow. In most instances of complexity of insert form, number or position, the molding material, at low initial pressures, is sufficiently semi-solid to bend or break the inserts. This condition is obviated by applying the initial pressures in a loading chamber. Applying the pressures in this chamber immediately before permitting the molding material to flow to the die space insures the plasticity of the material when contact is made with the inserts. This is the basic principle of transfer molding.



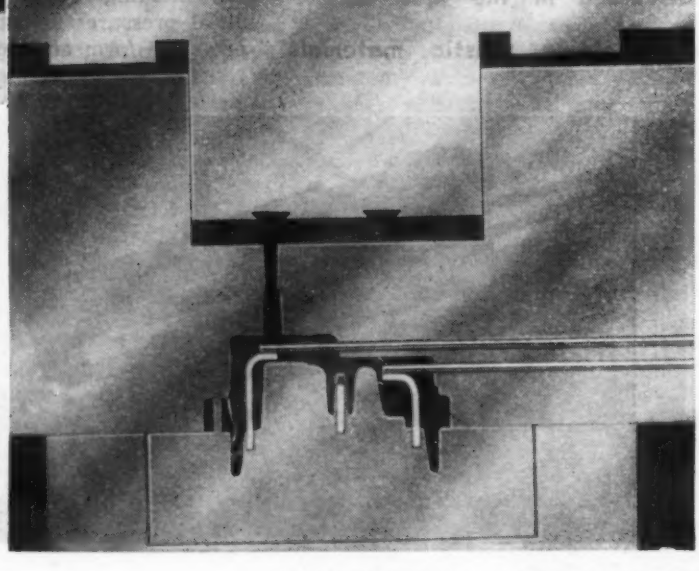
Long, slender inserts that are surrounded by a large mass of plastic material can be produced by the transfer method of molding. The forces and conditions inherent with compression molding would distort or break such parts during the molding process. As the objectionable forces are controllable or absent in the transfer process, the parts can be molded with accuracy



The die must be kept free of foreign greases or dust particles to insure a cleanly molded part. The parting contacts in particular must be kept free of extraneous matter to permit full closure



An up-moving ram moves the core section into the mold chamber until the parting lands are contacted to close the die and move the mold section upward. This action causes the stationary top plunger to enter the loading chamber and exert the pressure of the ram on the preform



Application of pressure on the hot preform causes it to become plastic and to flow through the sprue. Air displaced by the material entering the closed die space passes out

The loading chamber is designed to restrict the free flow of the material in such manner that it will not flow into the die space until it has become sufficiently plastic to flow smoothly around the inserts. This is accomplished by providing a restricted passage from the loading chamber to the die space. These passages are called sprues. The dimension of the sprue must be carefully calculated with consideration for the type of molding material and the filler used. Requirements of the die space must also be considered. The proper sprue area may have to be divided between several sprues to assure complete delivery of material to all parts of the die.

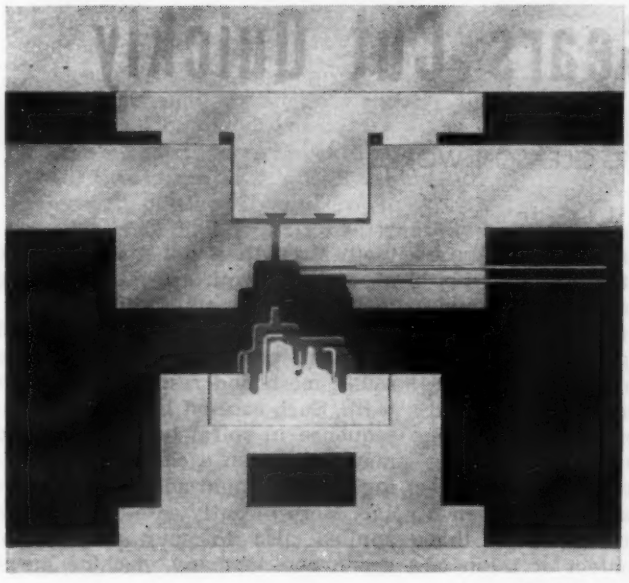
Molds Must Be Accurate

The die cavity is usually formed by two parts, the upper section containing both the force and the cylinder of the loading chamber, and the lower section which serves as the cavity and has provision for holding inserts.

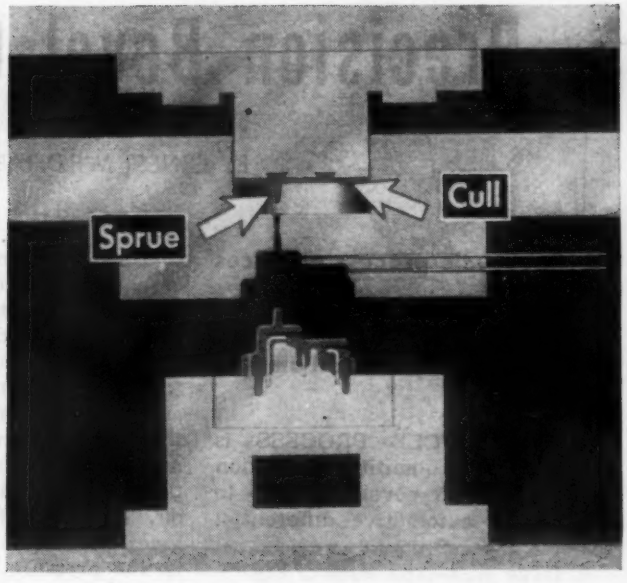
The force must be removable from the cavity to permit withdrawal of the molded part. The force is closely fitted to the cavity at the parting line as is the plunger to the wall of the loading chamber. Close fitting of these parts is necessary to hold the material in the loading chamber and die space under the high molding pressures involved.

The holes for maintaining the position of inserts must be a close fit with the inserts. If the inserts fit the holes loosely, the material will flow into the space and result in ruining the piece when it is withdrawn.

The contours of pieces for which



Removable cores in the mold section are retracted and the press opened to lower the core section. The sprue is provided with a constriction that causes the material remaining in it to break at that point when the core section is dropped. The molded part shrinks after polymerization and clings to the core pattern



The mold section containing the compression cylinder is lowered away from the top plunger. The cull is attached to the top plunger by dovetail slots that insure against the cull sticking in the cylinder. A dovetail is usually placed directly over a sprue to provide a firm grip. The cull is removed by sliding out of the dovetails

the transfer method of molding is usually selected are, in general, quite complex. They are likely to have many sections that are trapped in small spaces in the core or mold or both. These convolutions greatly increase the surface area of the molded part in contact with the mold. Unless the contacting surfaces of the mold are highly polished and free of minute scratches, bumps or hollows, the material will flow into the metal and cause difficulty in withdrawing the part. On dies with very small spaces between projections or with small irregularly shaped projections or unusually odd shaped holes, the best method of achieving the most desirable finish is to polish the sections mechanically to the best surface obtainable and finish by electrolytic polishing. This method will level sharp irregularities and result in a finish comparable to that obtained by employing the honing process.

Removable cores used to core holes that are not axially parallel to the motion of the press should be fitted as closely as possible to the mold lead holes to prevent the material from compacting between surfaces of the core pin and the hole.

As transfer molding consists of the injection of material from a pressure chamber to a closed die space, provision must be made for the release of air entrapped and compressed during the molding operation. Usual practice is to provide air vents at the parting line in the lower face of the contact seal. The vent terminates in a small overflow pot that permits easy removal of material that may escape through the vent.

The critical factor in obtaining satisfactory results by transfer molding is precision in mating individual parts of the mold. The high molding pressures and complete plasticity of molding compositions cause the material to flow to minute crevices of mold openings. Unless all parts are fitted to exceptionally close tolerances, the material will form flash at imperfections and require excessive finishing. Although the functional requirements of inserts may not demand precision tolerances, they must be held to close fits with holding members in the mold to prevent imperfections in molding. All phases of mold construction demand the best precision obtainable to produce satisfactory moldings at a reasonable unit cost.

Removal of the molded part from the core completes the molding cycle. The pieces must be removed with care to avoid damaging the inserts or the core. The thin flash that occurs at the parting line is easy to remove and in some cases, may not require removal. The gates are located in the best possible position for easy removal contingent on the molding requirements

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In a third article in this series on molding plastics, Mr. Buchanan will discuss heating and preforming the materials.

Precision Bevel Gears Cut Quickly

BY ERNEST WILDHABER, GLEASON WORKS

The Revacycle process produces finely finished teeth eased off at their ends to any desired amount

THE REVACYCLE PROCESS is used for large quantity production of straight-tooth bevel gears up to the size of automotive differential gears.

A large disk-type cutter, Fig. 1, finishes both sides of a tooth space in a single turn from the solid blank, at least when the tooth depth is not greater than 7/16 in. It contains concave cutting edges to produce convex tooth profiles and is sharpened by regrinding the plane cutting faces. It is relief ground to cut the same shape during its whole life.

The cutter turns continuously and at a uniform rate. During each turn it is first fed in one direction along a tooth space to rough out the tooth space and then back again to finish it.

With this process it takes only 2½ to 3½ sec. to complete a tooth space of a passenger car differential pinion or gear; that is, a ten-tooth pinion is completed from the solid in 25 to 35 sec. The gears so produced transmit uniform motion just as accurately as generated gears, and they are less sensitive to misalignment or deflection in the mounting than gears produced without ease-off. The ease-off at the tooth ends gives a localized tooth bearing; that is, the pressure contact or mesh of the teeth does not sweep the entire tooth surface of the gear teeth, but only a central area when moderately loaded and run on exact centers.

This bearing area shows up clearly at the central portion of the tooth surfaces of a pair of Gleason Revacycle gears, Fig. 2. It shifts when the gears are run in a slightly different mounting position, the more so the larger the bearing area. With full bearing area and zero ease-off, all gears are extremely sensitive, and the heaviest tooth bearing is likely to shift to a tooth end at the slightest provocation. The inherent tooth strength is not made full use of, and the teeth are more exposed to scoring and other difficulties.

Ease-off keeps the heavy loads off the tooth ends and thereby insures sound mesh and results in stronger teeth. Such ease-off is a natural consequence in spiral bevel gears, and may have been a chief factor leading to their rapid adoption 30 years ago. More recently ease-off has been applied also to spur and helical gears, and to many machine parts.

Ease-off Easily Attained

In the Revacycle process any desired amount of ease-off may be attained at will. It is built into the cutter shape. Ordinarily about 0.0015 in. ease-off is provided at the tooth ends on differential gears; that is, the separation of the two members is about 0.0015 in. at both ends of the teeth, when they are run together on their exact centers with a light load.

A plan view, Fig. 3, shows the cutter in engagement with a pinion or gear blank *B*, in a position where a

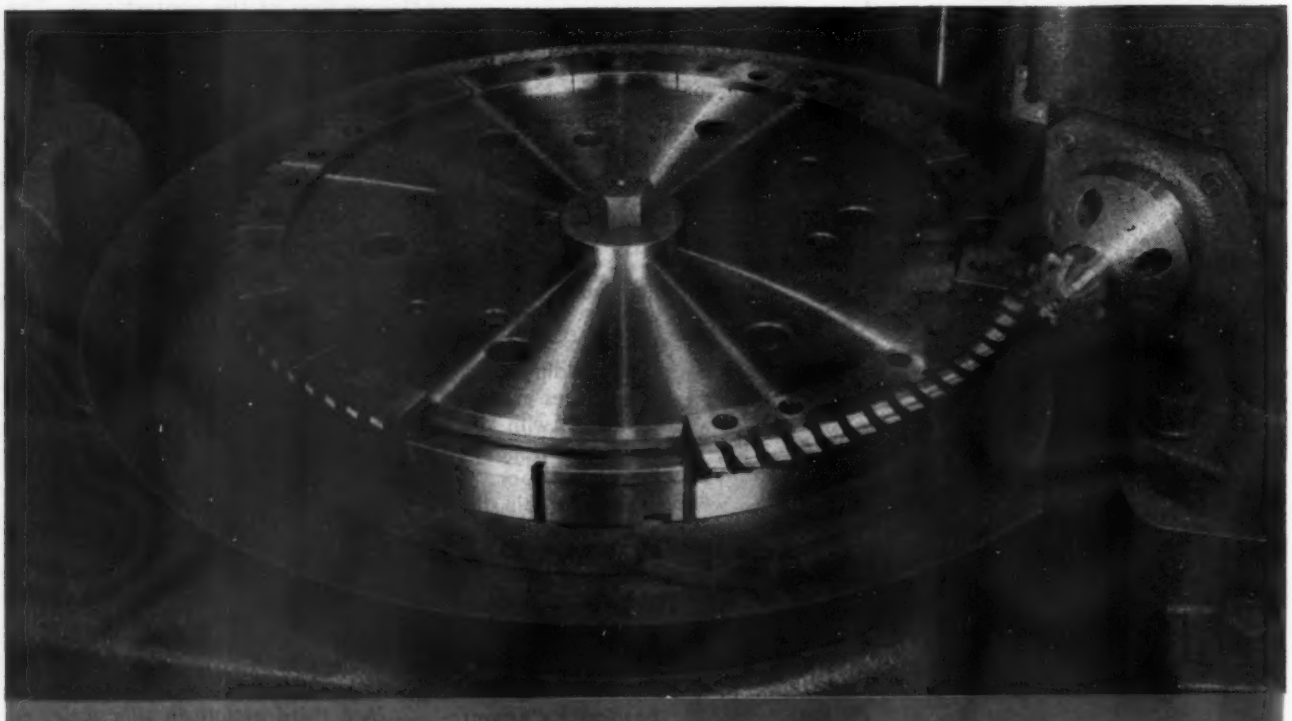


Fig. 1—A disk cutter roughs and finishes a tooth space in a single revolution. Note the gap in cutter teeth at the front to permit indexing the gear blank

mean point of the gear is being finished. An axial section of the cutter appears at the right.

Concave cutting edges are provided on segments *S*, which are rigidly secured to the cutter head.

The cut starts when the cutter center *C* is in position *C'*, with roughing edges *E'* cutting at the crown or tooth top of the blank. The cutter is then gradually fed by a cam towards the large end of the teeth, or heel, as the roughing edges take out the stock, cutting chiefly with their wide tops. The chip thickness of this roughing cut is controlled largely by the top spiral of the cutter, that is by the shape of spiral S_t, Fig. 3, along which the top cutting edges are arranged. Full cutting depth may have been reached when the cutter center has moved to position *C*. The cutter is then rapidly fed to its extreme heel position, where its center is at *C"* and where the feed direction is reversed.

The return feed is ordinarily performed at a uniform rate, and the finishing cut is then applied by the fishing edges *E"*, which usually number about 18 to 20. This number is sufficient to give a smooth finish because of the intimate contact between the concave cutting edges and the surface produced thereby.

The gear blank is indexed when the cutter gap provided between the last finishing blade and the first roughing blade is abreast of it.

Fig. 4 is an axial section of a Revacycle pinion or gear, taken through the center of a tooth space and drawn at a larger scale than Fig. 3. It shows the lengthwise shape

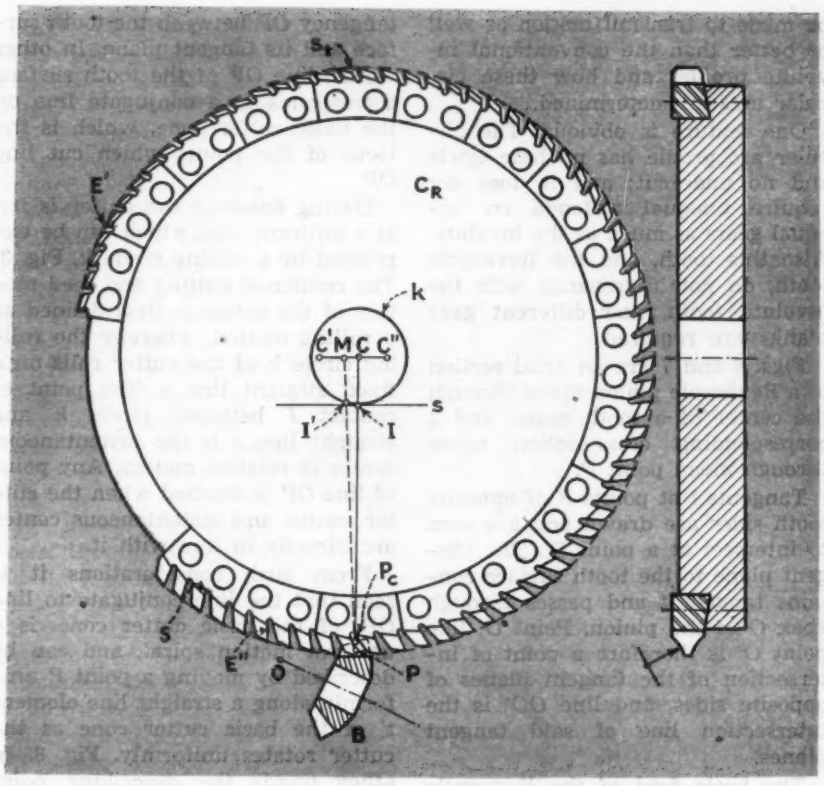
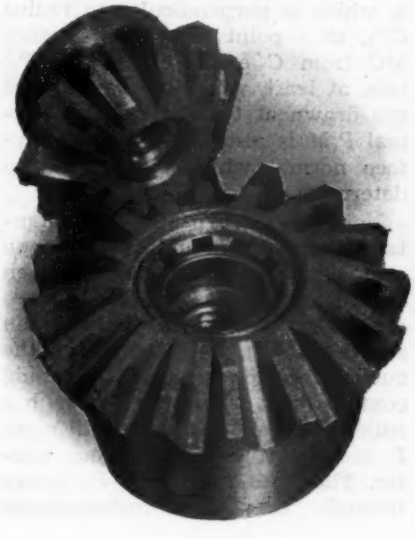


Fig. 3—The cutter has a top spiral to provide an increasing depth of cut; the center of rotation is shifted during each revolution so the cutter teeth traverse the entire length of the gear tooth space

Fig. 2—Easing the ends of the teeth throws the tooth bearing toward the center, thus avoiding undesirable end bearing



of the roughing chips, exaggerated as to their thickness. Actually about 50 depth roughing chips are formed. Note the length of the chips. A cross-section, Fig. 5, shows diagrammatically the width of the chips.

Inasmuch as a single cutter turn is used for cutting an entire tooth space, each blade performs only a single cut in that tooth space. It cuts a definite portion in it. Each finishing edge cuts a definite line on the tooth surface, which is not touched by any other finishing edge. There are edges which cut near the large end of the teeth or heel, other edges which cut at and near the middle of the teeth, and still other edges which cut near the small end of the teeth, that is, near the toe.

Blade Requirements

The Revacycle process calls for different shapes on the different blades, so that the blades which cut near the heel produce a profile suited for the heel, that is, a profile larger and less sharply curved than the mean profile; and so that the blades which cut at the toe produce a profile suited for the toe, which is smaller and more curved than the mean profile and the heel profile.

The problem is now reduced to determining the shape of the cutter, and to finding a way of accurately making it. The cutter is the key to the Revacycle process; everything is built into it. The Revacycle machine itself is simple and can be kept very rugged.

Two chief factors turn the cutter problem from an engineer's nightmare into a straightforward and practical procedure:

1. The side cutting edges are made circular arcs;

2. All the side cutting edges are circular arcs of equal radius, having centers which are displaced on different blades. The side profiles of different blades are different only insofar as they have a different position. They can, however, all be ground with the same wheel, which has to be fed accordingly.

The selection of circular-arc cutting edges results in tooth profiles which depart from the conventional involute profiles. Usually the tooth profiles will be circular arcs too.

Circular-arc tooth profiles have been known as an approximation of involute profiles and as such give inferior results. That is not what is used on Revacycle gears.

A subsequent article will describe what can really be done with profiles consisting of single circular arcs, how circular arc profiles can

be made to transmit motion as well or better than the conventional involute profiles and how these circular arcs are determined.

One feature is obvious: The circular arc profile has no base circle and no undercut; and it does not require unequal addenda on unequal gears as much as the involute. Also this tooth, and the Revacycle tooth, do not interchange with the involute tooth, and different gear blanks are required.

Figs. 6 and 7 are an axial section of a Revacycle pinion taken through the center of a tooth space, and a corresponding cross-section taken through mean point P.

Tangents t at points P of opposite tooth sides are drawn and are seen to intersect at a point O'. The tangent plane to the tooth surface contains tangent t and passes through apex O of the pinion. Point O, like point O' is therefore a point of intersection of the tangent planes of opposite sides, and line OO' is the intersection line of said tangent planes.

The basic feed of the Revacycle cutter is along this intersection line OO' of the tangent planes; and the root line of the tooth space is ordinarily made parallel to this line.

The two tangent planes form a V-shaped slot. And the actual tooth sides are tangent to the plane sides of this slot, except for the ease-off which is ordinarily applied to the gear and which can be disregarded in the present explanation of principles.

Conventional bevel gear teeth contact these tangent planes along straight line OP, that is along the extended connecting line between mean point P and apex O. And we shall start out with the same line of contact between a tooth side and its tangent plane.

The Basic Cutter Cone

If we had to produce only the V-shaped slot, an ordinary milling cutter with V-shaped cutting profile would merely be required. Its side cutting edges of each side would be located in and constitute a conical surface whose axis coincides with the cutter axis, and which will be called the basic cutter cone. If we were to cut with this imaginary cutter, its conical cutting surface would envelop and generate the tangent plane conjugate thereto, and one of its points would finish mean point P of the tangent plane and tooth side.

Other points would finish the various points of the straight line of tangency OP between the tooth surface and its tangent plane. In other words, line OP of the tooth surface corresponds to a conjugate line on the basic cutter cone, which is the locus of the points which cut line OP.

During finishing the cutter is fed at a uniform rate, which can be expressed by a rolling circle k, Fig. 3. The combined cutting and feed motion of the cutter is then defined as a rolling motion, whereby the rolling circle k of the cutter rolls on a fixed straight line s. The point of contact I between circle k and straight line s is the instantaneous center of relative motion. Any point of line OP is finished when the cutter center and instantaneous center are directly in line with it.

From such considerations it is seen that the line conjugate to line OP, of the basic cutter cone, is a uniform motion spiral, and can be described by moving a point P uniformly along a straight line element t' of the basic cutter cone as the cutter rotates uniformly, Fig. 8. In other words the describing point moves in the axial plane of the cutter at a constant lead along a straight line inclined to the cutter axis.

As an intermediate step in our explanation let us consider a cutting surface, or locus of the cutting edges, having a concave profile q in an axial section of the cutter, as shown in Fig. 8. Profile q moreover is a circular arc, whose center is at Q.

This intermediate explanatory cutting surface is described by moving profile q in its plane along element t' of the basic cutter cone, so that its point of tangency P with said element describes the aforesaid spiral on the basic cutter cone.

The profile center Q then moves along a line p parallel to t' at a constant lead, so that its positions Q' and Q'', which correspond to equal turning angles of the cutter, are equally distant from mean position Q.

The tooth surface produced with such a cutting surface contacts with its tangent plane along line OP and has a convex profile.

This cutting surface is no longer a surface of revolution; and the surface normals do no longer all intersect the cutter axis. Only the normals along points of said spiral still do.

The surface normals, or perpendiculars to the cutting surface, are the items which control the contact between the cutting surface and the surface produced thereby. Any point of the cutting surface, that is of the continuous surface containing all the cutting edges, gets into contact with the surface produced thereby when its normal passes through the instantaneous axis of relative motion.

We shall now determine the normal to this considered cutting surface at any point P_c of the circular profile q. In the axial section Fig. 8 the surface normal at P_c appears as line QP_c. It is, however, not contained in the plane of the drawing, but is slightly inclined to it, and intersects this plane at P_c.

For determining the surface normal in a view along the cutter axis the tangent plane described by profile tangent t_c during an element of its lead motion will be analyzed. The profile tangent partakes in the lead motion of the whole profile, which is displaced in a direction parallel to t' a distance equal to the lead L per full turn of the cutter, or a distance $\frac{L}{2\pi}$, $\pi = 3.1416$ per one radian of turning. Thus point P_c moves to position P_c' per radian of turning, and distance P_cP_c' equals $\frac{L}{2\pi}$. Tangent t_c is then in a position t_c'. In this position it intersects the straight radial line drawn through point P_c at point P_r.

It is seen that the same tangent plane will be described by tangent t_c when it moves radially a distance P_cP_r as when it moves at an angle a distance P_cP_c' at the same time. Therefore the tangent plane at P_c, and the surface normal can be determined as if tangent t_c would move radially. Point P_c of the radially moving tangent then describes an Archimedean spiral. Its normal is known to intersect line $C'C''$, Fig. 3, which is perpendicular to radius CP_c, at a point M whose distance MC from C equals distance P_cP_r; this, at least, when the two figures are drawn at the same scale. Normal P_cM is also the projected surface normal which we set out to determine.

Normal P_cM bypasses the instantaneous center I, and therefore no contact exists at point P_c between the cutting surface and the surface generated thereby in the position shown in Fig. 3. Point P_c of the cutting surface gets into finishing contact only when the cutter has rolled further to the left until point I' becomes the instantaneous center. Then the normal at P_c passes through the new instantaneous

center. Point P_o is then in a position P_1, Fig. 6, which is drawn at the same scale as Fig. 8.

The finishing contact of other points of the axial cutting profile q can be similarly determined. All these points of finishing contact lie on a line w, Fig. 6, which extends diagonally across the tooth side. This line is the line of cut taken by cutting profile q.

The generated tooth surface, therefore, does not fit the cutting surface along an axial profile of the latter, but in a diagonal line. There is a discrepancy between the tooth surface and said cutting surface in the axial section. The tooth profile produced is more curved than the cutting profile contacting with it at point P.

The difference in curvature increases with increasing inclination Δ of line OP to line OO', and with increasing cutter radius R_c.

The radius ρ of cutting profile q and the radius of curvature R_p of the tooth surface in a normal section perpendicular to line OP are related in accordance with the formula:

$$\rho = R_p \ (1 + \tan^2\Delta) + \frac{R_c}{\sin i} \times \tan^2\Delta \left(1 - \frac{C}{R_c}\right)^2$$

Herein i denotes the angle between the elements of the basic cutter cone and a radial cutter plane, Fig. 8; and c denotes the radius of circle k. This formula is based on exact mathematical considerations which, however, cannot be elaborated here.

The discussed cutting surface, which has been used merely as an explanatory step, gives the same line w of finishing contact as the cutting surface actually used, but is found to give practically no change in tooth profile curvature from toe to heel.

The Secret of the Revacycle Cutter

And now we come to the actually used cutting surface with which the desired different profile curvatures along the teeth are obtained.

To cut these different profile curvatures with circular cutting profiles of constant radius, use is made of the difference in curvature between the cutting profile and the profile cut thereby. The secret of the Revacycle cutter is the control of this difference. This difference is held comparatively small at the heel or large end, and it is increased at the rate desired towards the toe or small end.

Angle Δ defines the inclination to line OO' of the line of contact between the tangent plane and the tooth surface. The above formula is not confined to a straight line of contact OP, when at any considered point of said line its tangent is used. Thus the inclination of said tangent is made smaller at the heel and larger at the toe, which then results in profile radii of curvature R_p larger at the heel and smaller at the toe, as desired.

The line of contact between the tooth surface and its tangent plane is then a curve v, Fig. 6, concave towards the tooth bottom. Its slight curvature is exaggerated in the drawing.

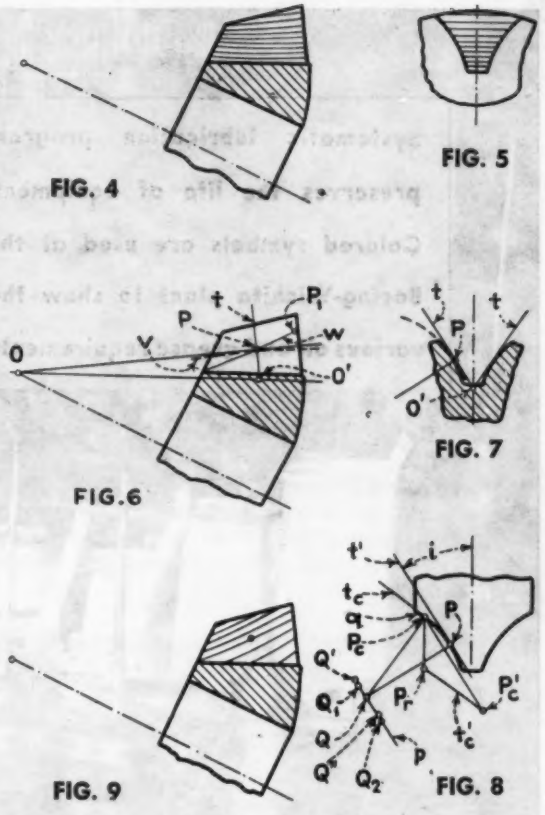
The mating tooth surface contacts with the same tangent plane along a similar line which is slightly concave towards its own tooth bottom.

The result of the oppositely curved lines of contact of mating tooth surfaces with their common tangent plane is merely a slight ease-off of the mating teeth at their ends. This ease-off is desirable, but much too small to give full benefit of ease-off. The main part of the ease-off is obtained by thickening the cutter blades which operate at the tooth ends. The total ease-off is assumed to start with and is carried through all the computations.

Further modifications made in the process to extend its scope do not need to be gone into here.

The cutting surface of the actual Revacycle cutter can be described by the circular arc profile q, Fig. 8, of an axial cutter section, by moving profile q tangentially along element t' of the basic cutter cone at a varying rate. Thus for equal turning angles of the cutter the profile center Q is displaced through unequal distances Q_1Q, QQ_2. In other words a constantly varying lead is used.

An axial section of a pinion or gear, Fig. 9, shows the diagonal lines of the finishing cuts. These lines somewhat tend to straighten up towards the heel, as a result of the varying cutter lead provided. Their inclination to line OP increases from toe to heel.



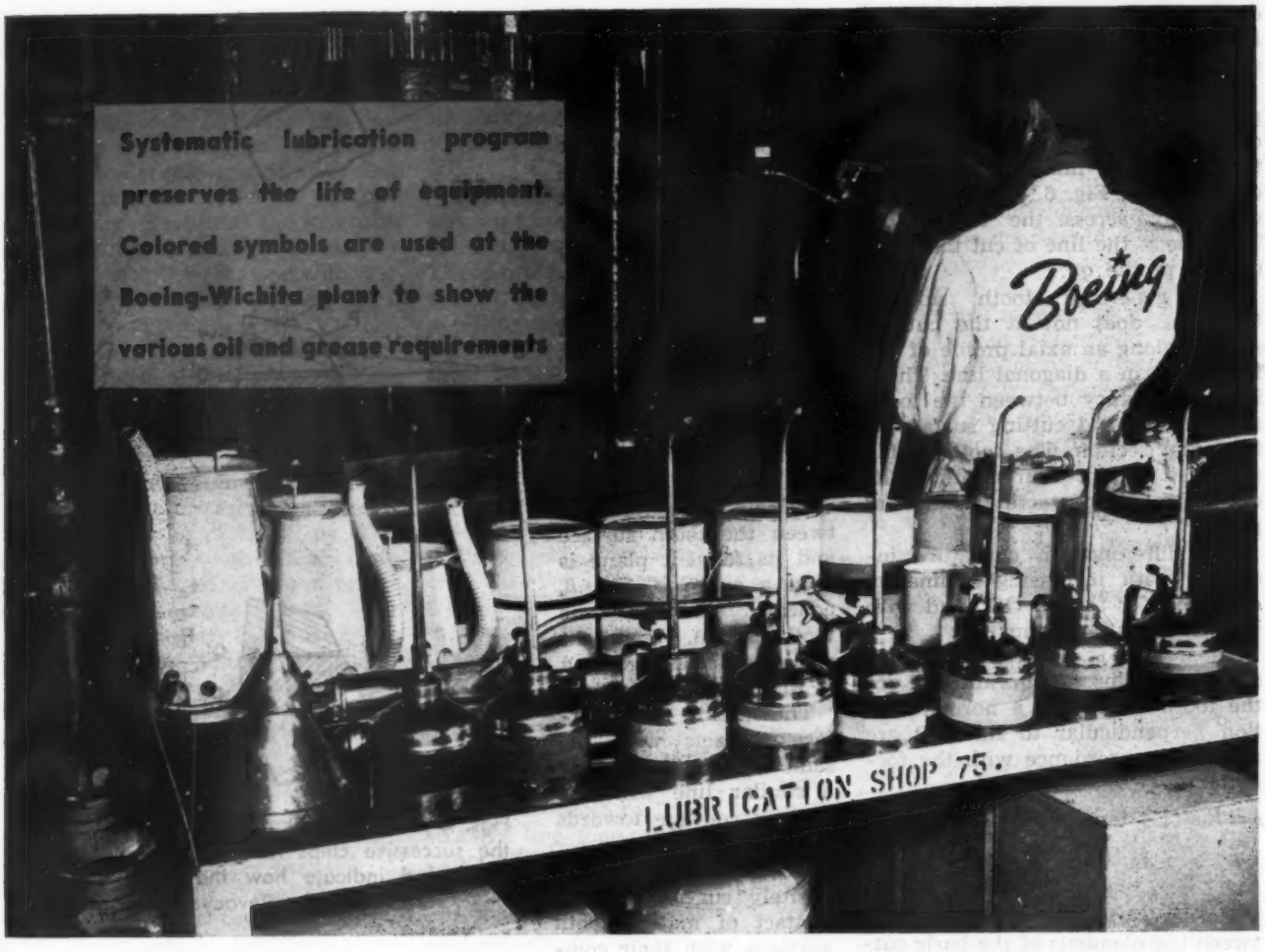
Figs. 4 to 9—Sections of tooth spaces indicate the successive chips taken during the cutting cycle and indicate how the tooth shape is formed by the Revacycle process

Gears of this character run well and have a good square bearing, Fig. 2.

Even after the cutters are made, alterations can be made in the position of the tooth bearing, and to a limited extent also in its shape. Thus the tooth bearing of each side can be placed anywhere on the tooth surface at will. Also, if through inaccuracies of the machine set-up the tooth bearing of the two sides should not be at the desired spot, usually near the tooth middle when the gears are run on correct centers, correction can immediately be obtained by the following procedure:

The tooth bearing of each side is brought to the desired position by adjusting the testing machine, and the departures from correct centers are noted. These departures may be quite different on the two sides. With this information, setting changes on the Revacycle completing machine are readily computed; and a pinion and gear is then cut with the changed settings.

If the computed setting changes are carefully made the bearing of the new gear pair will be exactly where desired.


Systematic lubrication program preserves the life of equipment. Colored symbols are used at the Boeing-Wichita plant to show the various oil and grease requirements
Boeing
LUBRICATION SHOP 75

A completely equipped lubrication cart accompanies each group of machine oilers on regularly scheduled trips through the shop. Each container on the cart is marked with a symbol indicating the kind of oil or grease it contains

Lubrication Needs for Machines Indicated by Color Code System

BY W. H. HELMS, SUPERINTENDENT OF PLANT PLANNING AND EQUIPMENT CONTROL
WICHITA DIVISION, BOEING AIRPLANE COMPANY

ENGINEERED LUBRICATION of machine tools and other equipment has supplanted the old-style oiler with his all-purpose oil can, grease can and pocket full of cotton waste in the Wichita Division of the Boeing Airplane Company. Now trained crews of maintenance men oil and grease every machine with the proper lubricants at the proper time.

In purchasing expensive, precision machinery to equip its multi-million dollar Wichita plant, Boeing knew that the machinery must be made to perform efficiently for the duration of the war. That meant careful, controlled lubrication to reduce wear to a minimum. Experienced oilers were not available, so a departure from conventional practices was necessary. Boeing engineers wrote to every machine manufacturer for oiling charts and lubricant specifications. These were put on record and maintenance men were trained to care for and service the machines.

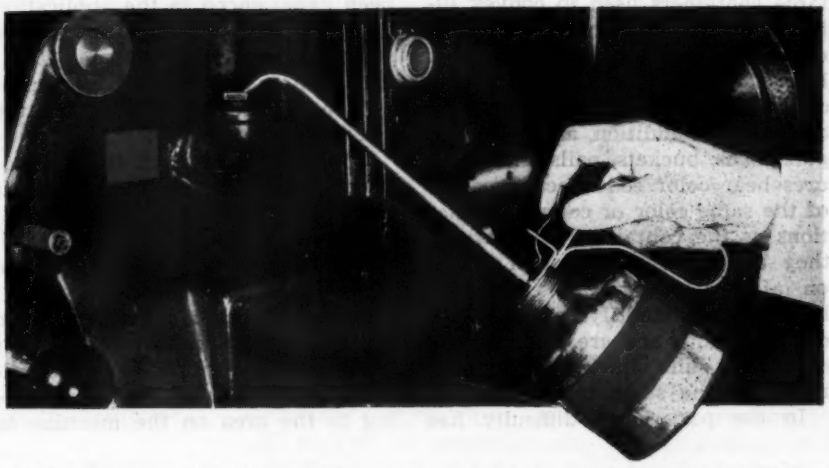
Then, G. F. Keeley, at that time a Boeing employee, suggested a plan to insure that each machine would be lubricated correctly at proper intervals. Keeley's plan, since copyrighted, called for marking each barrel of grease or oil with a distinctive color combination. A similar color combination was painted on

oil and grease cans from which the maintenance men would lubricate the machine in their assigned areas. Finally, to complete the chain, the same color code combinations were painted above each oil hole and grease cup on each machine. The shape of the color markings on the machines indicate how often oil or grease should be added at each station.

Carts Transport Lubricants

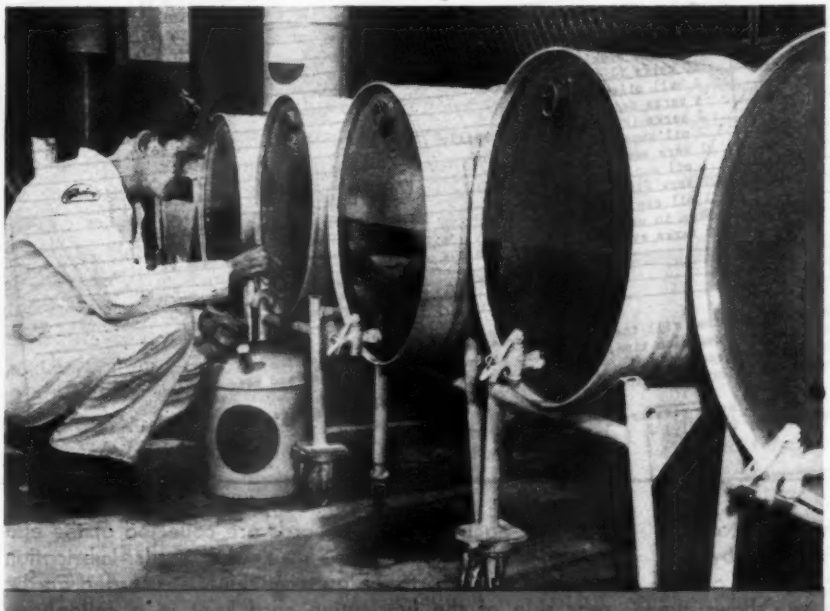
Now, each Boeing-Wichita oiler takes with him, as he moves from machine to machine through his assigned factory area, a lubrication cart which is, in effect, a portable service station. On this cart are containers with half a dozen or more grades of oil and as many kinds of grease. At each machine he finds an oil and grease service record card which indicates when each station on that machine should be lubricated, and what kind of lubricant to use at each station. In addition, the lubrication symbols on the machine give a double-check of the kind of lubricant and frequency of lubrication for each station. The oiler selects a container carrying the same color code symbol as that applied at the station he must lubricate on the machine. By checking off on the record card each station lubricated, he and his supervisors have a permanent record of when each station was lubricated.

The oil and grease service record cards for each machine are replaced monthly with new cards, and the old cards are delivered to the superintendent of the plant planning and equipment control department. In this office, the cards are reviewed carefully and where specified lubrication operations are not checked, an investigation is made to determine why that operation was not performed. Careful follow-up in this manner keeps the oilers aware of the need for careful, adequate lubrication of each machine. Another result of the lubrication control system employed at the Wichita plant is the prevention of over-lubrication. Experience has shown that too much oil is as bad as not enough and every effort is made to insure that each station on each machine is lubricated only as frequently as necessary.



Each oil cup or other lubrication point on a machine is marked with a color-code decalcomania indicating the type of lubricant required. The oiler need only select a container marked with the same color code from his nearby cart when lubrication is necessary at that point

Required lubrication periods may be established by varying the shapes of the color-coded decalcomanias applied to the machines at the various lubrication points



The head of each barrel of grease or oil is painted with a distinctive color code when received from the supplier. Special carts hold oil drums horizontally for easy filling of smaller containers

Colors Identify Greases, Oils

The Boeing-Wichita plant purchases eight kinds of greases and 20 kinds of oils. These lubricants range from light mineral oils to heavy graphited greases. All refinery sealed drums, kegs and other containers are identified with paint, or with a decalcomania transfer prior to the time they are placed in service. The color employed, or the combination of colors, corresponds with that shown on a color code chart which lists every lubricant regularly used in the plant. All por-

table containers used to convey lubricants from the original containers to other sections of the factory bear the same color code identification as the drums from which they are filled. In addition, all dispensing guns, cans, buckets, pails and measures bear color code decalcomanias of the same color or color combinations as the containers from which they are filled. Lubrication points on all machinery and equipment have similar identifying code-color decalcomanias and are filled with a dispensing unit having a decalcomania of the same color.

In the past, some difficulty has been experienced in the application of color-code decalcomania to the surfaces of machine tools and lubricant containers. The following procedure proved satisfactory at the Boeing-Wichita plant:

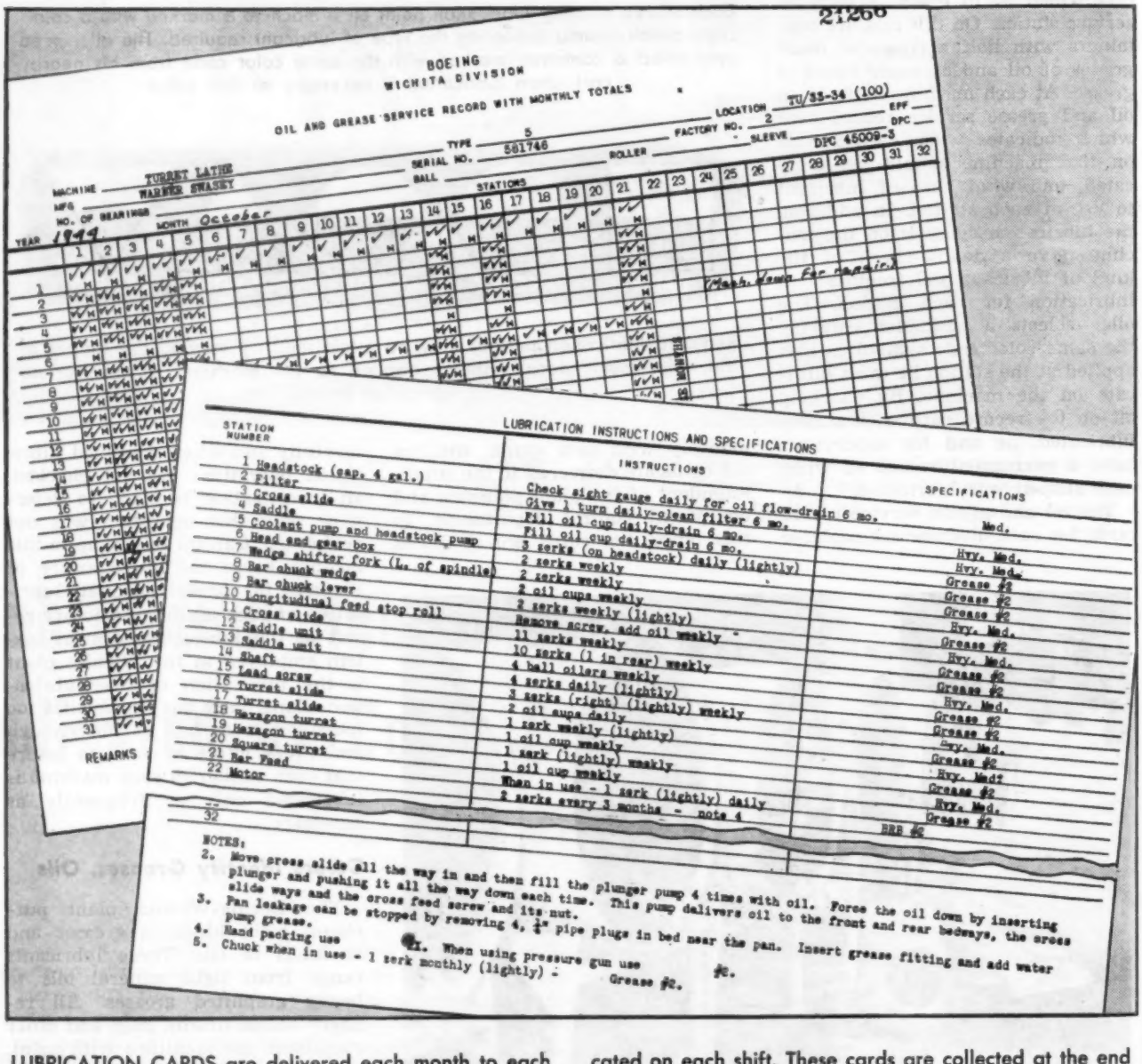
1. The area on which the declacomania is to be mounted first is wiped clean of oil and dirt.

2. This area is coated lightly with white shellac, which is allowed to dry for a minute or more.

3. The decalcomania is submerged in a pail of lukewarm water for about one minute. Then, the decalcomania is slid from its paper backing to the area on the machine or lubricant container already prepared for its application. Here, it is smoothed out to remove bubbles.

4. The decalcomania then is wiped dry and coated with shellac.

The color code system of lubrication facilitates the training of workers in this important job. Strict adherence to rules regarding written data on the work performed permits a close check on maintenance requirements. Proof of the benefits of organized lubrication procedure is demonstrated by the fact that machines have successfully met heavy operating schedules induced by the war.


21266
BOEING
WICHITA DIVISION
OIL AND GREASE SERVICE RECORD WITH MONTHLY TOTALS
MACHINE TURRET LATHE
MFG WARNER SWASEY
NO. OF BEARINGS
YEAR 1944
MONTH October
TYPE 5
SERIAL NO. 581746
BALL
ROLLER
LOCATION TU/33-34 (100)
FACTORY NO. 2
SLEEVE
EFF
DPC
DPC 45009-3
STATIONS
MONTHS
REMARKS
LUBRICATION INSTRUCTIONS AND SPECIFICATIONS
STATION NUMBER
INSTRUCTIONS
SPECIFICATIONS
1 Headstock (cap. 4 gal.) — Check sight gauge daily for oil flow-drain 6 mo. — Med.
2 Filter — Give 1 turn daily-clean filter 6 mo. — Hvy. Med.
3 Cross slide — Fill oil cup daily-drain 6 mo. — Hvy. Med.
4 Saddle — Fill oil cup daily-drain 6 mo. — Grease #2
5 Coolant pump and headstock pump — 3 serks (on headstock) daily (lightly) — Grease #2
6 Head and gear box — 2 serks weekly — Grease #2
7 Wedge shifter fork (L. of spindle) — 2 serks weekly — Hvy. Med.
8 Bar chuck wedge — 2 oil cups weekly — Grease #2
9 Bar chuck lever — 2 serks weekly (lightly) — Hvy. Med.
10 Longitudinal feed stop roll — Remove screw, add oil weekly - — Grease #2
11 Cross slide — 11 serks weekly — Grease #2
12 Saddle unit — 10 serks (1 in rear) weekly — Hvy. Med.
13 Saddle unit — 4 ball oilers weekly — Grease #2
14 Shaft — 4 serks daily (lightly) — Grease #2
15 Lead screw — 3 serks (right) (lightly) weekly — Hvy. Med.
16 Turret slide — 2 oil cups daily — Grease #2
17 Turret slide — 1 serk weekly (lightly) — Grease #2
18 Hexagon turret — 1 oil cup weekly — Hvy. Med.
19 Hexagon turret — 1 serk (lightly) weekly — Grease #2
20 Square turret — 1 oil cup weekly — Hvy. Med?
21 Bar Feed — When in use - 1 serk (lightly) daily — Grease #2
22 Motor — 2 serks every 3 months - note 4 — Hvy. Med.
32 — BRB #2
NOTES:
2. Move cross slide all the way in and then fill the plunger pump 4 times with oil. Force the oil down by inserting plunger and pushing it all the way down each time. This pump delivers oil to the front and rear bedways, the cross slide ways and the cross feed screw and its nut.
3. Pan leakage can be stopped by removing 4, 1/4" pipe plugs in bed near the pan. Insert grease fitting and add water pump grease.
4. Hand packing use #2. When using pressure gun use #2.
5. Chuck when in use - 1 serk monthly (lightly) - Grease #2.

LUBRICATION CARDS are delivered each month to each machine so oilers will have definite instructions covering frequency of lubrication necessary at each station on the machine. Front of this card, shown above, shows the stations to be lubricated on each date, and provides space for the oiler to check off the stations he has lubricated. Two check marks indicate that the station was lubricated on each shift. These cards are collected at the end of the month, then replaced with new cards. Lubrication required at each station on a machine is recorded on the rear side of the lubrication card kept in a cellophane envelope at the machine. Complete instructions insure adequate lubrication of every bearing, and reduce the tendency to over-lubricate

RUSSIA AND AMERICA

ALLIES—or else . . .

VICTORY in Europe was won only through the combined endeavor of the United Nations. Only through sustained joint effort can the fruits of that victory be reaped.

Without disparaging the truly heroic contributions of others, three of the Allies may fairly be credited with having made the major contributions to victory over the European Axis—the United Kingdom, Russia, and the United States. The close accord of these three nations is no less crucial to the accomplishment of the tasks that remain.

First of these is the war against Japan. It still requires winning. Even without any help from others, the United States could make good this victory, but the war's duration will be speeded by the marshaled effort of the United Nations.

Next, and not less important, is the task of establishing a basis for enduring peace. In this struggle our enemies are more formidable than any we have faced—national ambitions, prejudices, suspicions and distrusts, the staggering burden of tradition and debilitating cynicism born of past failure, the cleaving wedges of divergent languages, thought patterns, economic creeds and procedures—an array of difficulties as baffling as fog and as formidable as a deluge. They can be vanquished only by a continuance of the working accord between the United States, Russia, and Britain that was forged on the anvil of European conflict.

☆ ☆ ☆

This high appraisal of the decisive importance of the Big Three in determining the destiny of the United Nations organization, in no way depreciates the importance of the role to be played by France, by China, or the other freedom-seeking nations represented at San Francisco. All of us are committed to the building of a genuinely representative security organization in the conviction that by such means alone can we possibly achieve a just and lasting peace. But the strength of any international machinery will depend upon the validity of Russian-British-American cooperation. If these three are able to achieve substantial harmony of aim and procedure, a world organization that includes them can operate with effective coherence. If they pull apart, the United Nations will break up into competing and jealously hostile blocs.

This is inevitable because of the sheer weight of these three nations in the world's affairs. Between them they account for perhaps half of the world's income and from two-thirds to three-quarters of its industrial output. Once Japan has been crushed, they will control an overwhelming preponderance of the world's armed might. Each of them will wield military power on a scale quite beyond the power of any embryo security league to hold in check. Only if all three are resolved to keep the peace and to enforce it through the Security Council, can that body hope to accomplish its aim.

Although there is a tendency on both sides of the Atlantic to indulge somewhat recklessly in mutual criticism, the ties between Britain and America are too firm to be severed by any foreseeable strain. But that has not been true of our relations with Russia. Even while fighting a war in which our respective ways-of-life were at stake, the inestimable services of each to the other were rendered as friendly but independent associates rather than as fully trusted partners. Now again, as we approach the difficult and vitally important task of building a world organization and of devising a European peace, the task of our delegates is complicated by national attitudes under which each hopes for the best from the other, while fearing the worst.

But the stakes for us both—and for the rest of the world—are too high to be played for in a diplomatic poker game. Russia has no inhibitions in demanding what she wants, and our own vital interests must be stated and upheld with undeviating firmness. Yet we both must face the stark fact that few advantages that either nation might gain at the cost of dissipating the good will of our wartime association could be worth the price thus paid.

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The first steps toward establishing confidence lie in a frank recognition of what may contribute to the lack of it and in a definition of what can be done to restore it.

1. *Probably the greatest single area of reciprocal distrust between Russia and our own country is based on the fear of each that the other may try to interfere with its domestic, economic, and political affairs.* Each purports to see the beam of meddlesome intervention in the other's eye, while it ignores the mote in its own. Thus the Soviet Union remembers that we participated in the foreign military intervention at the time of her civil revolution, and afterwards lent our support to successive boycotts of her trade, of her gold, and of her credit needs. For our part, we remember the Soviet Union's doctrine, and

aggressive support, of revolutionary international communism.

We feel that Russia should find satisfactory evidence of our present willingness to have her develop her internal institutions as she will in the aid that we have given her during the war, and in the record of our good-neighbor policy as applied to Latin America. She, no doubt, resents our lingering suspicions in the face of her declared policy of 1941 to refrain from any attempt to influence the political or economic structure of foreign nations. Certainly, each of us will need the repeated reassurance that can come only through sustained performance by the other in the years ahead. Meanwhile, much will be gained if each will give to the other's good faith the benefit of the doubt, while it scrupulously guards its own conduct to avoid even the appearance of backsliding.

2. *A second zone of suspicion is created by those measures which each of us interprets as natural and necessary bulwarks of national security when they are our own, but as evidence of dangerously aggressive imperialism when taken by the other.* In our view, at least, such demands as we have voiced for island trusteeships or for other naval bases appear mildly conservative as compared with Soviet claims for annexation of territory and for a general orbit of influence, under governments friendly to her, throughout eastern Europe in particular.

There can be no easy solution to that problem. Bi-focal vision, by which one nation can look through a second lens ground to the prescription of another, seldom is achieved in international affairs. The success of the San Francisco Conference will provide a mechanism for international definition of principles and procedures which at least might relieve the inevitable strains. Most important will be the record of how each of us proceeds in our respective courses of action. Soviet performance thus far is highly unsatisfactory to us. While we have taken pains to clear our procedure with her, she has taken action in the Baltic, in Austria, and in Poland without even advance notice to us.

A major test of our ability to cooperate may be found in the Allied administration of conquered Germany. The proposed four-headed control of a four-way partitioned nation promises to be at best an extremely awkward mechanism of administration. At worst, it can result in continuous and dangerous bickering between the representatives of Britain, France, the United States, and Russia in the Berlin coordinating center, and in hopelessly divergent procedures in their several zones of administration. There will be a compelling need for all of us to exercise all of the wisdom and cooperative resolve that we possibly can muster.

3. *A third testing ground for the future of American-Soviet relationships will be defined by the course of Russia in our continuing war with Japan. We are not unmindful of the toll paid by the Soviet Union in its magnificent European war effort. But we still are locked in a desperate struggle with an enemy that exemplifies the Fascism which America and Russia equally denounce. And that war is being fought in an area where Russian interests are importantly at stake.*

Russia has an extraordinary opportunity to create good will by throwing her weight speedily and effectively on our side. There is no doubt but that the final Pacific settlement will generate problems comparable with those of the European peace, but it is equally certain that the continuation of the European comradeship in arms can do much to promote an enduring and confident postwar friendship.

4. *A fourth, and highly important, potential source of suspicion and irritation is the intellectual blockade that the Soviet Union has maintained against the free flow of travel, intercourse, and exchange of ideas.* We can understand the genesis of this policy and the reasons for its continuance while Russia entertained a constant fear of attack by powerful enemies. But the sustained perpetuation of such a quarantine by so strong a nation as the present U.S.S.R. could not be accepted as a protective measure. Inevitably it would generate suspicion that it was rather an instrument of nationalistic isolation or even of contemplated aggression. A way-of-living, at arm's length, with a nation that maintains such intellectual quarantines is possible; any whole-hearted partnership of effort is quite impracticable.

5. *Trading between a free-enterprise nation and one that operates all foreign commerce as a government monopoly can give rise to many frictions.* That subject is too complicated for exposition here. Suffice it to say that, while difficult, it is not impossible to conduct such trade with mutual advantage. We are in a position to help Russia greatly with her program of industrial rehabilitation and expansion at great saving of cost in terms of her current scale of living. In return, we must have assurance that her government monopoly trading will be conducted for commercial rather than political ends, and that it will be used to encourage rather than to restrict multilateral and non-discriminatory world trade.

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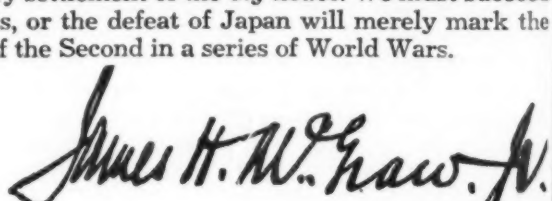
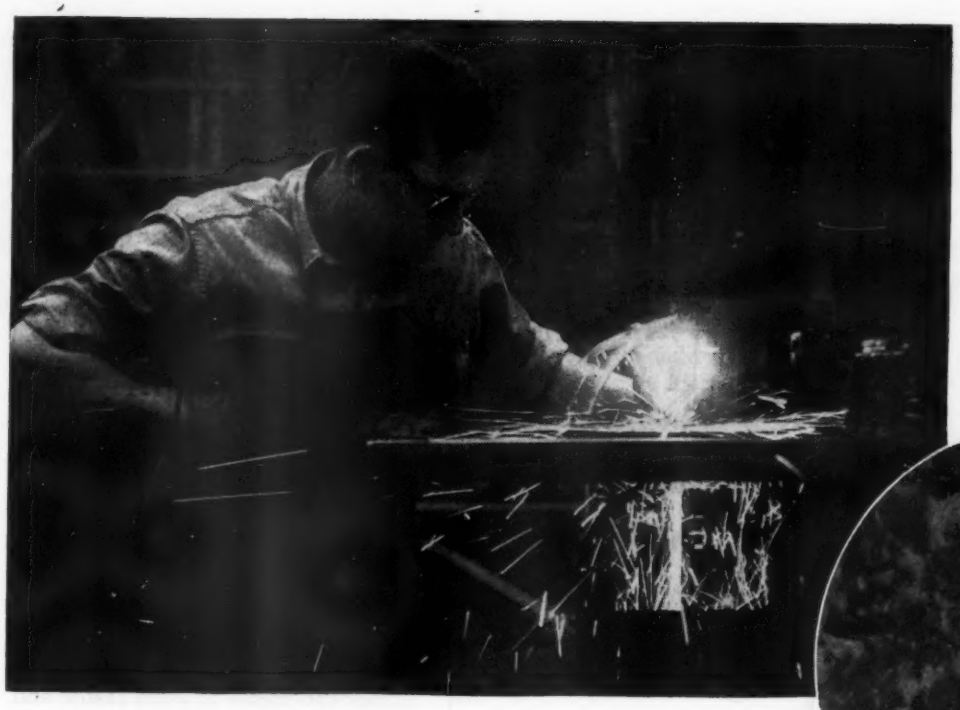
This is a representative list of the major areas in which misunderstanding and distrust may be generated, or allayed, in Russian-American relationships. No doubt, an equally honest list drawn by a citizen of the Soviet Union would be more heavily weighted by those features of our behavior which irritate and stimulate distrust on their side. If such a catalog were to be presented, it should receive our most searching and responsible consideration.

For it is of utmost importance that our two nations, in concert with the other United Nations, learn how to get along in mutual confidence and respect. Our understanding of each other now is so imperfect that our negotiations are punctuated with continuous irritations over *little issues.* This, inevitably, will continue until such matters are submerged in the general confidence that can be achieved only through satisfactory settlement of the *big issues.* We must succeed in this, or the defeat of Japan will merely mark the end of the Second in a series of World Wars.



President, McGraw-Hill Publishing Co., Inc.



Sparks fly when plate materials are friction sawn at 12,000 surface ft. per min. Production rates average six times faster than for conventional bandsawing

Heat generated by the flying saw blade fuses the metal: to obtain these globular "chips" it was necessary to catch in water the metal that was melted and burned out of the cut

Friction Sawing

PROVES FASTER IN CUTTING PARTS FROM PLATE

BY R. C. HOLLOWAY, SUPERVISOR OF TOOLS, LINDEN PLANT, EASTERN AIRCRAFT DIVISION, GENERAL MOTORS CORPORATION

Conversion of a conventional bandsaw to friction sawing was not undertaken as a stunt: if an operation yields only a few pieces per hour, a production-minded executive gets busy

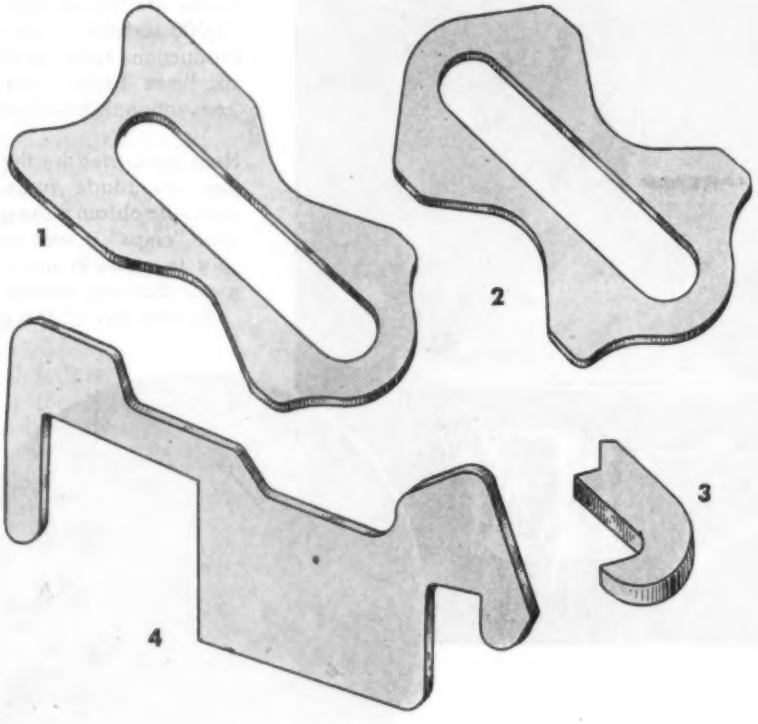
TO SAVE TIME in machining straight and contoured parts from plate materials, we decided to experiment with friction sawing. For this purpose we rewound the motor of a conventional Tannewitz 3-H bandsaw to drive a stock blade (14-teeth per in., ½ in. wide) at 12,000 surface ft. per min. Perhaps a variable-speed drive might be better in that the operator would be able to select the proper cutting speed for a given material and avoid surface hardening of the cut surface. This consideration was not especially important to us. We were merely interested in quickly devising a machine that would save considerable time per piece as compared to conventional bandsawing or milling operations.

At present, a number of aircraft parts are now quickly cut to the proper outline by friction sawing. Plate materials, chiefly SAE 4140, stainless steel and armor plate, are blued and a part layout is made to a templet. Then the part is friction sawn at production rates in the order of six times faster than bandsawing. The scribed line is easily followed to within 0.015 in.

Friction sawing causes a slight burr to be thrown up on both sides of the part. In some cases, the deburring time is increased, although the operation is done usually with a buffing wheel. Also the hardness of the cut edge on alloy materials may be increased to depth of approximately 0.005 in. It is good practice to anneal the friction-sawn piece before profile milling because the practice will increase the life of the milling cutters many times over. But despite these disadvantages, their importance is negligible in relation to the time saved by friction sawing. This is particularly true of armor plate, which often defies usual shop equipment and methods in respect to satisfactory production rates.

A conventional bandsaw blade is used. Before placing a new saw in production use, a few cuts are made through an old file in order to dull the teeth and increase the friction developed. These teeth then last the life of the blade or approximately 40 hours of use.

A high surface speed is not the only important factor in friction sawing. It is true that the object of the high speed is to create by



TYPICAL AIRCRAFT PARTS PRODUCED BY FRICTION SAWING

No.	Name	Material	Thickness, Inches	Pieces per Hour	
				Bandsaw	Friction Saw
1	Fitting	SAE 4130 125,000 psi.	5/16	2	12
2	Fitting	SAE 4130 125,000 psi.	5/16	5	13
3	Hook	SAE 4130	3/8	5	30
4	Hinge	Steel 180,000 psi.	5/16	1.5	10

FEED RATES FOR FRICTION SAWING

(Straight cuts at 12,000 s.f.p.m.)

Material	Thickness, Inches	Feed In. per Min.
SAE 4140 steel	5/16	20
Stainless steel	1/8	80
Armor plate	5/16	12
"Tantung" toolbits	1/4	3
"Delloy" toolbits	1/2	1
"Circle C" toolbits	5/16	2

friction such a high temperature in a localized area that the metal will be melted. In fact the metal becomes so hot that it burns. This effect is increased by directing an air jet upon the cut from a ¼ in. nozzle located about ½ in. away from and placed at an angle of 45 deg. to the bandsaw blade. The "supercharging" effect of the jet causes the metal to burn faster and increases the life of the saw.

Approximate dimensions of pieces shown at left are: No. 1—13 x 6 in; No. 2—12 x 7 in., and No. 4—15 x 9 in. over-all.

In between production sawing jobs, the speeded-up bandsaw is used for friction sawing of toolbits in high-speed steel and cast cutting materials. So what started out to be an adaptation of a well-known process used in steel mills for cutting billets has proved to be a useful method of saving time on a wide variety of bandsawing jobs.

Ordnance-Industry Teamwork in Peactime

PRACTICAL TEAMWORK between industry and Ordnance in times of peace is advanced by K. T. Keller, president of the Chrysler Corporation, as part of a preparedness pattern that will insure America's security in the world ahead.

Drawing on his experience of having engaged in the manufacture of weapons in two world wars, Mr. Keller advocates future preparedness in the form of keeping abreast of the know-how in weapons and weapon design and manufacture. It is just as important from the viewpoint of national security that those in industry and in the Army and Navy who are responsible for producing things that are needed in war should continue in peacetime to approach mutual responsibilities with a desire to keep abreast of respective abilities, limitations and possibilities.

Pointing to the Army Ordnance Association, Mr. Keller cites it as a perfect liaison unit. Its membership consists of men in the services and men in industry who know how to design weapons, and how to make them, test them, and use them.

"The liaison between these groups should not be allowed to vanish," Mr. Keller contends. "The Army and Navy have a better appreciation today of engineering and manufacturing problems involved in the design and production of war weapons. Industry has a better appreciation than ever before of the Army's talents in the field of weapon conception and use.

"What is needed is for this team to continue to function so that industry will know what the Ordnance people have in mind; so that the Ordnance people will know what is necessary from an engineering and production standpoint to make it.

"We have seen the marvelous weapons that have come forth during even the last few months and others still more remarkable are now in development. What has been done under the stress of fighting a strong enemy certainly can be done even more effectively when we are not retarded and diverted by the emergencies that require so much of our attention.

"Weapons of war will change as the latest developments of science, engineering, and manufacturing processes advance in this country. We cannot afford to be sluggish in keeping abreast of such advancements."

Practical Ideas

HAVE YOU A PRACTICAL IDEA?...If so, send it in. Your idea will help other men, in other shops, who have a problem similar to yours. We pay for acceptable contributions prepared exclusively for this publication

Rotating Quadrant Seam Welds Inside and Outside Curves

BY OLIVER DOUTT
Puget Sound Navy Yard

By altering a standard two electrode wheel welder, a two-piece elbow has been successfully welded. The finished product was not required to be airtight, because it was used for ventilation.

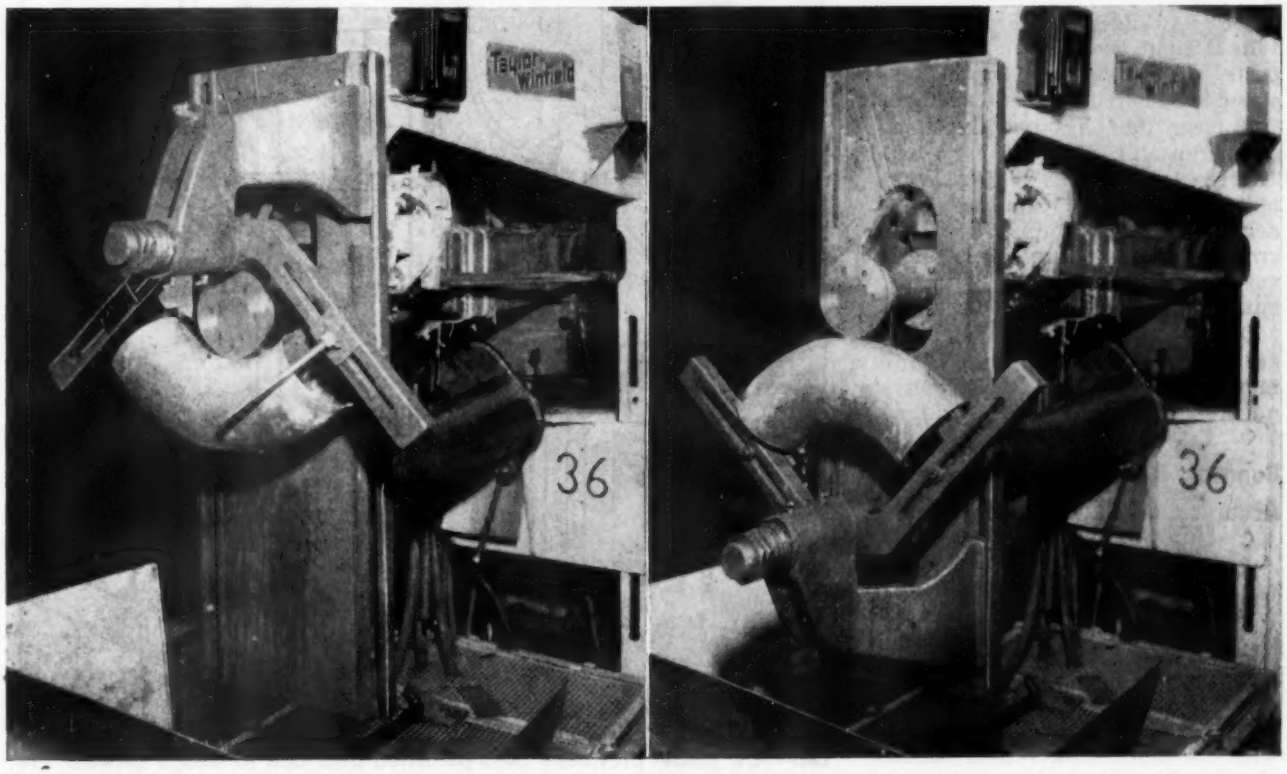
The lower electrode wheel was removed and in its place there is a copper quadrant which fits inside the elbow. This electrode is supported by a rotating quadrant to which quarter circle electrodes can be attached. With the change in size of the elbow, a different electrode must be used, and adjustment can be made to correspond to the electrodes by using bolts in the slotted arms.

Elbows are stamped in halves and placed on the curved electrode, then the wheel electrode is moved into contact. The quadrant is rotated as the lapped seam is welded: when the outside curve is completed, the quadrant position is changed to permit contact with the inside seam; in both instances, the curved copper electrode is in contact with the inside of the elbow. The resulting joint is smooth and tight and of good appearance. *War Winning Suggestion from the Board for Individual Awards, War Production Drive.*

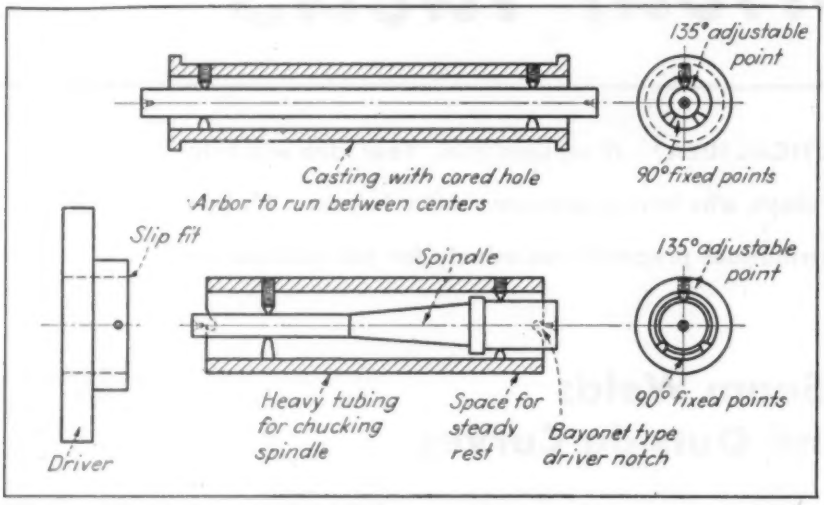
Three-Point Contact Centers Tubes and Bars for Machining

BY OSCAR I. CRAFT

Tubular castings, which are to be turned all over the outside and ends, are difficult to center, especially if the core is off center. By the use of an arbor with an adjustable support



Seam-welding two-piece lap-joint elbows produces a smooth and tight joint. The view at right shows the quadrant for outside welding, the other shows inside welding



Three point contact method is used successfully for holding hollow or solid objects for machining

at each end, a tube can be centered from its inside diameter and the excess metal removed from the outside diameter.

Two fixed supports at 90 deg. to each other and an adjustable support at 135 deg. are placed at each end of the arbor. This arbor is placed inside the tube, then the adjustable point is tightened. With this assembly, the wall thickness will not vary too much, because the inside diameter is still rough. The arbor is swung between centers.

In a similar way, bars, or other parts, already finished on the outside can be bored to great exactness.

A large tube has two fixed and one adjustable point at each end. The fixed points are 90 deg. apart, but the adjustable point is at 135 deg. from the others. By careful arrangement, the bore can be made very closely concentric with the outside diameter.

Once the fixed points of support are correctly located, the third movable contact will hold subsequent pieces properly centered.

Bandsaw Roller Guides Increase Accuracy and Reduce Breakage

BY HERMAN J. NOHL

Toolroom Foreman, Aircraft Engine Division, Packard Motor Car Company

Side guides regularly used for metal-cutting bandsaws are flat bars of steel bearing against each side of the blade. To hold saw into contact with the work, disk rollers backed up the blade. These guides accumulated a quantity of steel dust which would wedge between the blade and guides, causing friction, heating and frequent breaking. Pressure of the work against the saw caused the blade to twist, resulting in an inaccurate cut.

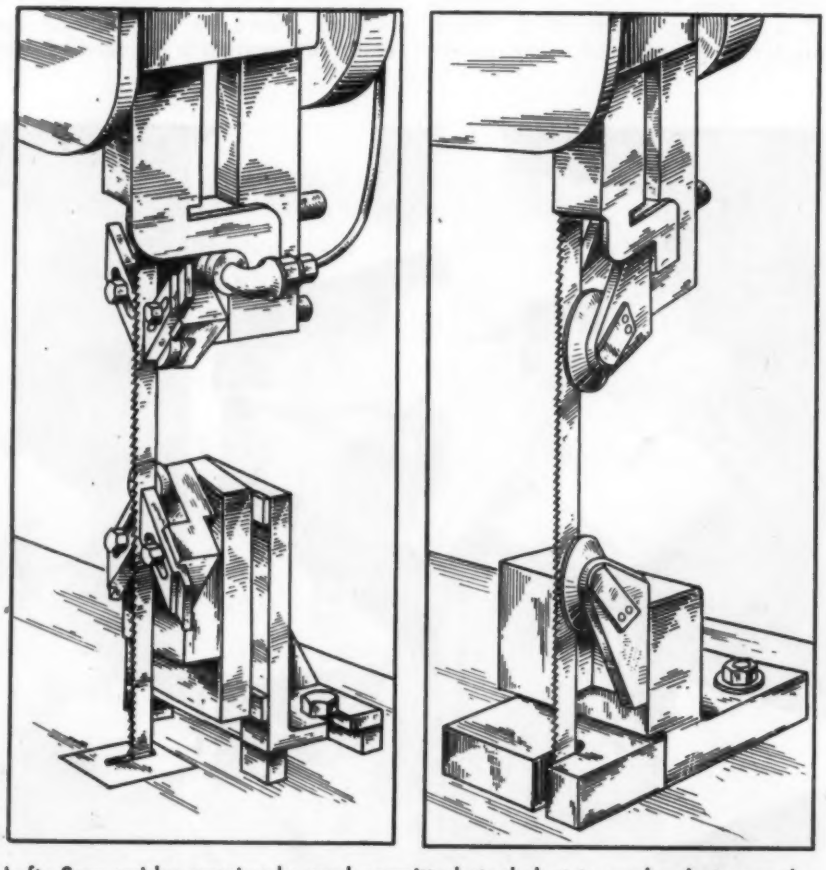
Roller guides were substituted, whose rim had a groove a trifle wider than the thickness of the blade and deep enough to clear the saw tooth gullet, thus backing up the blade to resist feeding pressure. By the use of this type of roller guide, the passage of the blade through the roller wiped off the steel dust and the long contact with the side of the groove held the blade rigid enough to prevent twisting, assuring an accurate cut. This method has reduced saw breakage by one-third with a very decided saving in labor. *War Winning Suggestion from the Board for Individual Awards, War Production Drive.*

Exhaust Hood on Rivet Gun Makes Grip Comfortable

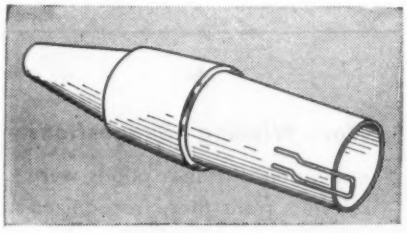
BY CARL PETERSON

Superintendent of Riveters, Moore Dry Dock Co., Oakland, Calif.

Constant contact of the rivet set with the hot rivet eventually transfers heat to the gun and makes it uncomfortably warm to operate. In



Left—Saw guides previously used permitted steel dust to wedge between the blade and guides without preventing twisting of the blade. Right—Grooved rollers wipe the blade clean and keep the blade straight



A rivet gun is more comfortable to the hand if outfitted with a snap-on hood that directs cooling exhaust air upon the rivet set

the meantime, compressed air at high pressure is used to deliver the blow on the rivet head, and the cool exhaust air is wasted to the atmosphere.

To permit continuous operation at a comfortable working temperature has been a problem which was solved by the use of a nozzle or hood directing the air from the outlet ports to the rivet set.

A hood to cover the end of the hammer is made of sheet steel. The upper tube fits the nose of the gun loosely and has a wire clip which slips over a bolt head on the gun to hold the hood in place. The middle cylindrical section fits over the upper part and is fastened to it, while the lower conical part fits inside the center section and clears the rivet set.

With a forced current of cool air flowing over the rivet set, the hammer can be used all day, driving over 1000 rivets, with comfort. *War Winning Suggestion from the Board for Individual Awards, War Production Drive.*

Targets Establish Coordinates for Laying Out Large Assemblies

BY SETH EVANS

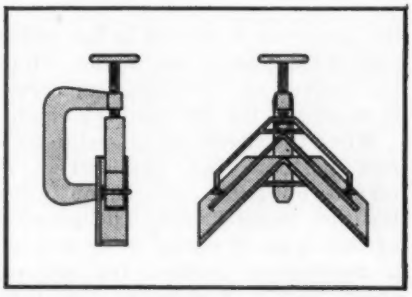
Machinist Foreman, Marinship Corp., Sausalito, Calif.

Accurate measurements of irregular shapes are rather difficult to obtain, because of the impossibility of establishing base lines upon the parts from which the layout can be made. In such cases, base lines at constant distances from some fixed position are necessary.

The customary method was to align the rudder upon a flat surface and measure from designated points; this was too slow and the opportunity for errors was great.

Correct laying-out was accomplished by mounting targets at both ends of the rudder. These targets have arms at right angles to each other. Between corresponding arms is stretched a wire under a fixed tension. From these wires, horizontal and vertical measurements are taken.

When the rudder was placed upon a flat surface, two men took 40 hours to set-up and the actual work was finished in two weeks of three shifts, the tolerance being 0.040 in. With the use of targets, set-up time was reduced to 2½ hours, the actual work was done in 9 days on three shifts and the tolerance was 0.005 inch. *War Winning Suggestion from the Board for Individual Awards, War Production Drive.*



An angle clamp holds metal sheets for tack welding and helps to form a good joint

Angle Clamp Holds Sheets for Welding Sharp Corners

BY CLIFFORD ELMER BROWN

Oregon Shipbuilding Corporation, Portland, Ore.

Tack welding of sheets at a right angle ordinarily requires a helper because of the difficulty of holding the edges in correct alignment. The helper can be eliminated by use of an angle clamp made of structural angles, flat bar stock and a C-clamp to grip and hold the edges in position during welding operations.

Two short angles are welded at right angles to each other, their legs upstanding to form a stop. The top of the clamp is flat bar steel welded to form a right angle, but the outer ends are guided by round bars sliding through U-bolts fastened to the angles. At the apexes of the angle and top clamp is welded a C-clamp;

Two targets, with wires stretched between corresponding horizontal and vertical arms, form a means for accurate laying-out of irregular shapes

the lower leg is welded at the under side of the joint of the angles, while the swivel on the adjusting screw is welded to the flat steel top clamp.

When the sheets are placed in correct position, the thumbscrew is turned until the top clamp grips the thin metal firmly. The purpose of this type of clamp is to provide a mechanical method for holding sheet metal in position for tack welding so that one man can make a workmanlike joint without other assistance. With such a clamp, the services of a helper are not required. *War Winning Suggestion from the Board for Individual Awards, War Production Drive.*

Wedge Roller Ratchet Replaces Ratchet and Pawl Feed

BY LAWRANCE J. DESPIERRE
Winchester Repeating Arms Co.,
New Haven, Conn.

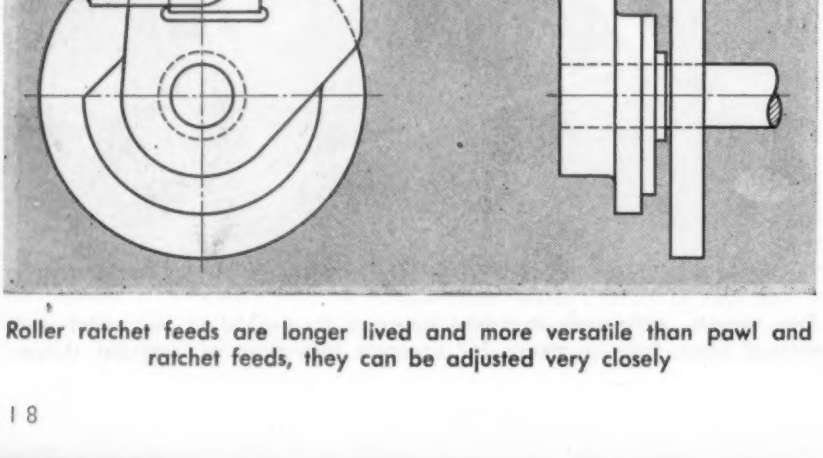
Feeds of the ratchet and pawl type are limited in usefulness to the number of teeth in the circumference of the wheel and the depth of each tooth. For certain feeds, either an appropriate wheel must be cut, or some over feeding will occur which has a tendency to be cumulative; also, dragging the pawl over the teeth wears the tips of the pawl and teeth very quickly, requiring replacement of expensive machined parts. Various types of steel have been used in an effort to reduce wear, without too promising results.

By adopting a smooth cylindrical surface and utilizing a roller running between the cylindrical surface and wedging itself against an inclined plane surface, not only was wear materially reduced, but an infinitely variable feed was obtained. The roller and both contacting surfaces were hardened.

The wedging surface is inclined a few degrees beyond the tangent to the wheel surface so that on the back stroke, a spring pushing against a T-rod holds the roller between the two contact surfaces, but the forward feeding stroke jams the roller tightly, locking the assembly and moving the material forward.

The limit of ratchet feeding is about 90 deg., that is, 45 deg. on either side of the center line of the stroke; it is better to utilize only 60 deg. total because the force reaction is not so severe between the roller, the ratchet arm and bearings.

If the wedge angle is too great, the force acting between the roller and its contacting surfaces is not large enough to elastically compress the metal, so slippage will result: when the angle is very small, the resulting forces between the surfaces are so great that permanent indentation or brinelling occurs, the wheel rim becomes corrugated, finally the mechanism refuses to operate.



Roller ratchet feeds are longer lived and more versatile than pawl and ratchet feeds, they can be adjusted very closely

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War - Winning Suggestions

appearing on these pages were selected from those recognized as meritorious by the Board for Individual Awards, War Production Drive. They are freely offered to industry as an aid to production of war material.

★

Deep hardening steel should be used so that it will not flow under conditions of large concentrated loads; shallow or surface hardening steels have only a skin deep surface, the core is soft and ductile, so case hardening is a wasteful process for this purpose.

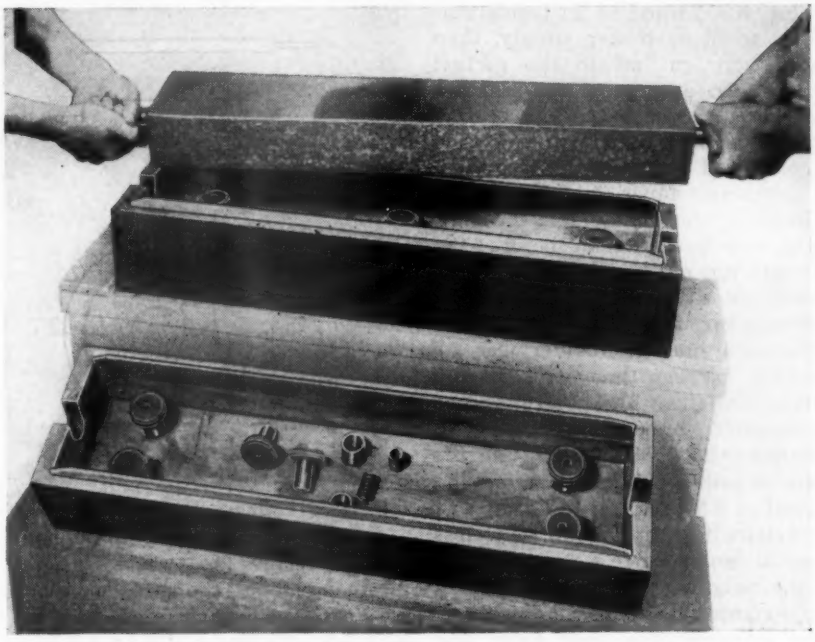
With teeth removed from the wheel surface, the roller is seldom in contact with the same spot, wear is distributed, long life is the result, without counting the manufacturing and shut-down expense, which means more productive hours per machine. *War Winning Suggestion from the Board for Individual Awards, War Production Drive.*

Spring-Cushioned Cases Preserve Instruments Against Shock

BY V. B. KUZMICH
Transportation & Generator Division
Westinghouse Electric & Manufacturing Company

Precision instruments become inaccurate if they are stored in places subject to much vibration. Felt and rubber eventually lose their elasticity because of compression, due to the weight of the instrument, and hardening due to age. If springs, of sufficient strength to support the load, are used there is no loss of flexibility, the instrument always rests upon a resilient base.

Cases built for heavy straight edges or squares must be quite substantial in their construction. Springs set in the bottom are placed in Micarta tubing which rests in holes drilled partway through the bottom of the box. Micarta-topped steel plungers are next placed on the springs, the stem of the plunger fitting inside the spring. Micarta plunger tops prevent rusting or



Spring-cushion supports should be placed at the corners of instrument cases, as shown at bottom, to prevent transmission of vibration to toolroom equipment. Then, as shown at top, the instrument, in this case a large straight edge, is placed on the cushion supports

marring of highly finished surfaces, the steel plunger gives added weight to keep it in place. This spring-cushioned assembly is more durable and shock absorbent than felt or rubber padding and is inexpensive to install.

When storing meters or other small instruments, a Micarta plate can be placed on plungers to form a flat surface on which various types of apparatus may be stored.

Carbide Inserts Improve Centerless Grinder Workrest

BY H. B. PRATT
Walker-Turner Company

Carbide workrests of various lengths have proved successful when made from standard carbide tips. Any convenient standard size of tip can be used; those actually employed were ⅝ in. long with 1/16 in. space between them.

Formerly these rests were made of high-speed steel or from long strips of tungsten-carbide brazed to a steel body. The carbide lasts up to 150 times as long as high-speed steel between grindings.

When long strips of carbide are used they must be brazed in a controlled-atmosphere furnace. A soft grade of carbide must be employed because with the harder grades there is danger of cracking.

By using standard tips the hardest grade of carbide can be used. In addition, these tips can be silver brazed to the cold-rolled steel body by means of an acetylene torch that makes the construction of a workrest a simple toolroom process.

The spaces between the tips are not an objection. In fact they provide a wiping action on the workpiece and permit clearance for the removal of fine chips. The design gives a degree of flexibility to the rest. In the event that one of the tips becomes cracked through hard service it can be replaced singly without damage to other parts of the rest.

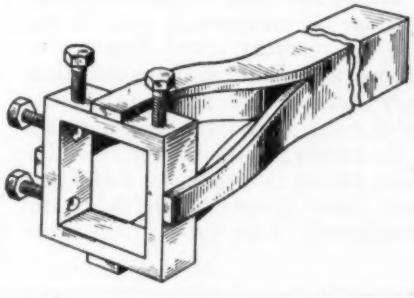
Any warpage that occurs in brazing the tip to the steel body is removed when it is clamped to the supporting member by countersunk screws. The hardness of the carbide tips prevents pick up of steel particles from the workpieces. Consequently the operator does not have to scrape the rest frequently as is necessary when steel rests are used.

Billet Chuck Makes Handling Large Bars More Convenient

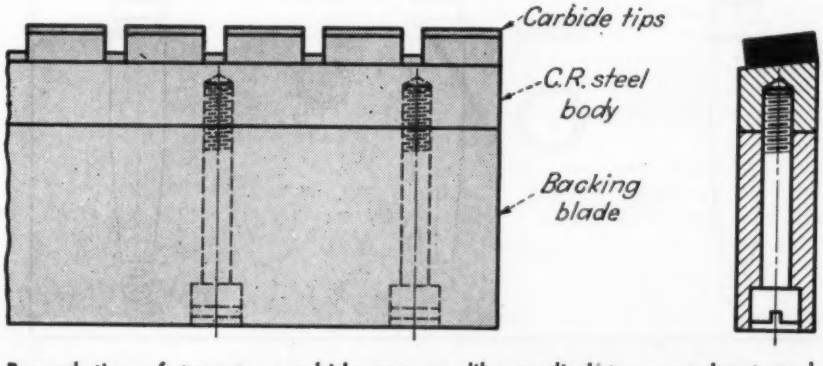
BY GEORGE C. FOSTER
Navy Yard, Portsmouth, N. H.

Billets were formerly clamped on by angle irons to oak timbers during heating operations. The process required workers to be subjected to much heat and other inconvenience during the heating and forging period, and there was poor control over the billet during forging.

With a rigid chuck fastened firmly to the billet, the metal to be heated is placed in the furnace and the operator can observe conditions at a comfortable distance, all the while controlling the billet with ease. In addition, any set-up material, or timbers for control, may be assembled during the heating period with-



A frame, suitable to hold the billet, is welded to a square sleeve capable of fitting a timber or bar for manipulating the forging



Brazed tips of tungsten carbide are readily applied to a workrest and greatly prolong its life

out being exposed to severe heat.

The size of the billet determines the type of chuck necessary for success, but, in general, an open square frame has two screws in each of two adjacent sides, and four strong fingers, from a square tubular section, are welded to the frame.

As an example of the convenience of this billet chuck, the previous method required five men eight hours to do the same amount of work as is now done by two men in one and a half hours. Skilled men are not necessary for successful processing of the forging, because the operator is assured of a solid grip upon the billets during forging, with resulting accurate control of the finish. *War Winning Suggestion from the Board for Individual Awards, War Production Drive.*

Torch Tips Reconditioned By Machining New Seats

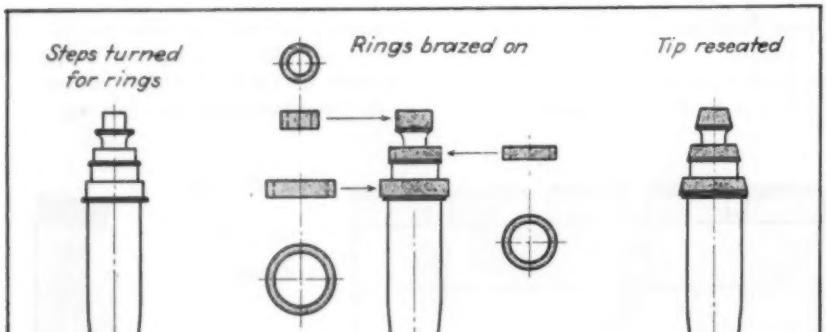
BY G. T. HAYES
California Shipbuilding Corporation

Due to use and normal wear, the tip seats finally cannot be made tight, so there is leakage between the oxygen and fuel gas, making it difficult to control the mixture, with a consequent loss in efficiency and wastage of compressed gas. If the tips are reseated, about four reconditions were the limit, at which time they became too small to fit the torch head, they then become scrap.

To prevent this wastage, the tips were placed in a chuck or collet and each seat turned cylindrical and shouldered. Also, some small brass tubing was turned to an inside diameter to fit each step snugly, then rings were cut off to the correct length. On each step a brass ring was placed, then fluxed and brazed. After brazing, the tip was placed in a collet and all the seats machined to the correct taper at one setting.

Because the metal for the new seats was harder than before, the surfaces did not nick so readily and the fit lasted longer.

Machining time for outside diameter and square shoulder was 2.5 minutes; average time per seat ring (machining them 1000 at a time) was 24 seconds; brazing time was 3.8 minutes; the taper turning of the seats required 3.2 minutes; making a total of 9.9 minutes; the total cost of reclaiming a tip amounted to less than 30 cents. Since a new tip costs in the neighborhood of $3.50 and a large company will use many thousand burning tips each year, the saving is something to be counted upon. *War Winning Suggestion from the Board for Individual Awards, War Production Drive.*

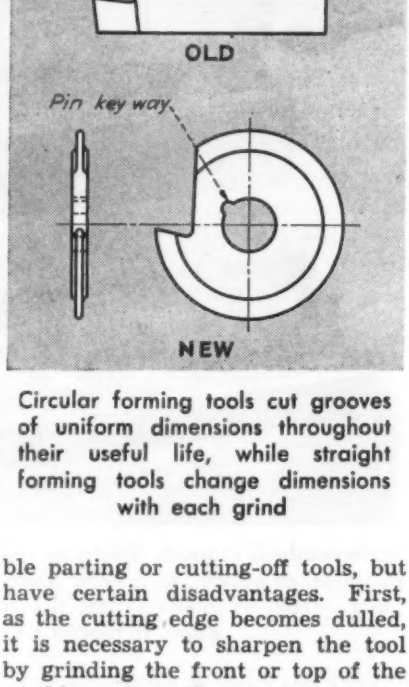


A series of light machihing operations and brazing sleeves to the seat steps returns otherwise serviceable cutting tips to a longer period of useful life

Circular Forming Tools Machine Accurate Grooves in Pistons

BY CHARLES A. BERTANG
Ford Instrument Company, Inc.,
Long Island City, N. Y.

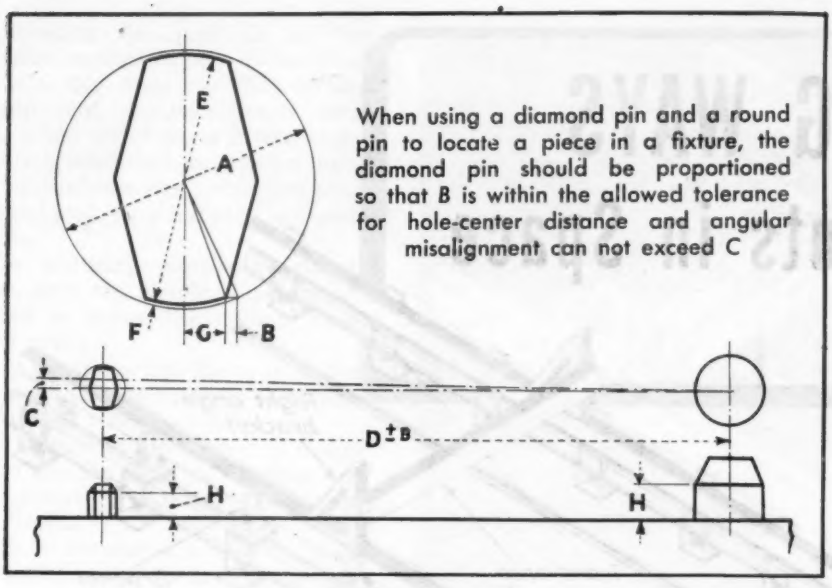
Pistons must have close-fitting rings to retain the high pressures imposed upon them. It is usual to machine piston grooves with gangs of cutting tools spaced in accordance with engineering dimensions and tolerances. These tools resemble parting or cutting-off tools, but have certain disadvantages. First, as the cutting edge becomes dulled, it is necessary to sharpen the tool by grinding the front or top of the working edge. In some instances both must be touched up, in other cases, only one surface need be dressed. Second, because of the nature of the cutting action, front, top and side rake must be ground on these surfaces. With each grinding, the width of the groove becomes progressively narrower until the groove makes too tight a fit for the ring of a narrower size.



Circular forming tools cut grooves of uniform dimensions throughout their useful life, while straight forming tools change dimensions with each grind

If a cutting tool can be made which will have a constant cutting width, no matter how often grinding becomes necessary, then grooves of uniform width and tolerance can be produced for the life of the tool. It is evident that a straight tool does not fulfil this condition.

Circular forming tools have regular dimensions throughout their circumference, and grinding occurs on the top of the cutting edge, so there is no change in shape in any cutting surface. If necessary, circular cutting tools can be ground to widths so that the land between the grooves can be obtained simply by keying the circular forming tools side by side on a mandrel, with this arrangement, all cutting edges can be ground as a group with the assurance each one will cut grooves of the same dimensions as its neighbor. *War Winning Suggestion from the Board for Individual Awards, War Production Drive.*



When using a diamond pin and a round pin to locate a piece in a fixture, the diamond pin should be proportioned so that B is within the allowed tolerance for hole-center distance and angular misalignment can not exceed C

Diamond-Pin Calculations

ASSURE CORRECT PART LOCATION

BY EDWARD J. CHARTIER, CHIEF CHECKER
TOOL DESIGN DEPARTMENT, BELL AIRCRAFT CORPORATION

IN REPETITIVE manufacture, it is customary to drill locating holes in parts at an early stage, so that the pieces can be positioned properly in jigs or fixtures designed for subsequent operations. These fixtures may be equipped with two round locating pins for the drilled part if the tolerance on the hole-center distance is close. But if the tolerance is fairly large, it is convenient to use one round pin made to the minimum diameter of the hole and one diamond-shaped pin. The latter construction restrains the part from angular misalignment in the fixture within close limits, but accommodates parts in which the hole spacing varies within comparatively large limits.

Often the diamond pin is dimensioned by guesswork. Few designers calculate whether the desired tolerance will be maintained. The following equations enable him to determine the proper proportions of the diamond pin. By reference to the illustration, let:

With the equations provided the tool designer can check whether the diamond pin will locate the piece correctly in the fixture

A = Minimum diameter of hole
B = One-half the total tolerance on hole-center distance D
C = Maximum permissible angular tolerance, which is often set at arc sin 10 min. 20 sec. = 0.003, when the part drawing tolerance is ± ½ deg.
D = Nominal hole center distance
E = Maximum diameter of diamond pin
F = 0.003 D for values of D up to 1.000; and 0.003 for values of D above 1.000
G = Dimension on diamond pin

From the illustration, it is evident that:

$$\left(\frac{E}{2}\right)^2 - G^2 = \left(\frac{E}{2} + F\right)^2 - \left(G + B\right)^2$$

$$\frac{E^2}{4} - G^2 = \frac{E^2}{4} + EF + F^2 - G^2 - 2GB - B^2$$

$$B^2 + 2GB = F^2 + EF$$

$$B^2 + 2GB = \left(\frac{A-E}{2}\right)^2 + \left(\frac{A-E}{2}\right)E$$

$$B^2 + 2GB = \frac{A^2 - 2AE + E^2}{4} + \frac{AE - E^2}{2}$$

$$B^2 + 2GB = \frac{A^2 - E^2}{4}$$

$$G = \frac{EF + F^2 - B^2}{2B}$$

Also:

$$E = A - 2F$$

$$F = \frac{A-E}{2}$$

If G should be equal to $\frac{A}{2}$ or greater, two round pins may be used.

The following example will demonstrate use of these equations:

Given: $D = 6.000 \pm 0.010$; $A = 1.000$; $F = 0.003$

Then:

$$E = A - 2F$$
$$= 1.000 - 2 \times 0.003$$
$$= 0.994$$

$$G = \frac{EF + F^2 - B^2}{2B} =$$

$$\frac{0.994 \times 0.003 + \sqrt{0.003^2 - 0.010^2}}{2 \times 0.010}$$

$$= 0.1445$$

It is possible with these equations to check the tolerance on the hole-center distance which will be allowed by a given diamond pin. For example, let:

$G = 0.047$; $A = 0.190$;
$E = 0.185 \pm 0.001$
Solve for B, as follows:

$$B^2 + 2GB = \frac{A^2 - E^2}{4}$$

$B^2 + 0.094\,B = 0.000376$

$B = 0.0045$, the maximum plus or minus tolerance that the pin will allow on the hole-center distance.

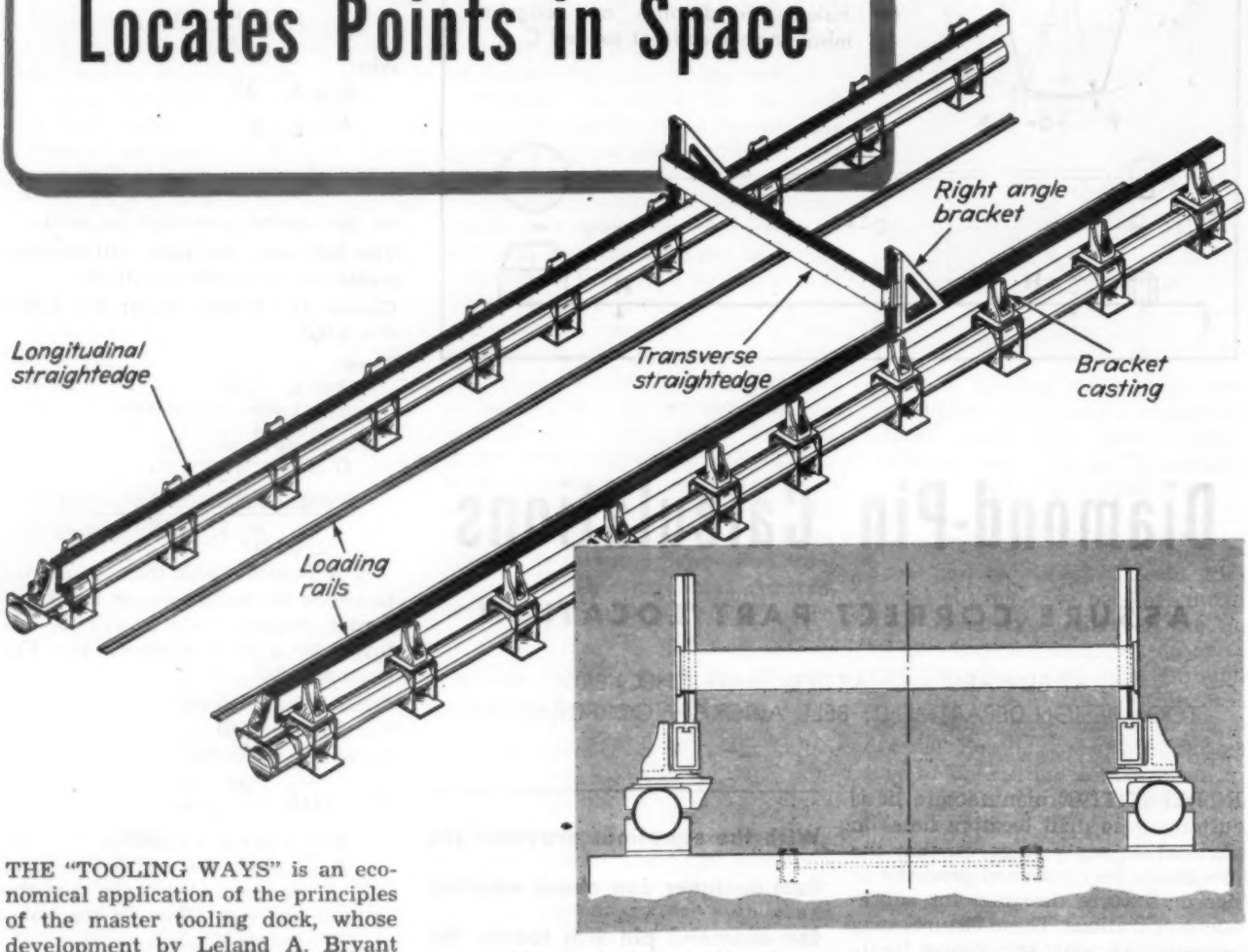
The tolerance on angular misalignment of the piece that will be allowed by this pin is found by the equation:

$$\text{Sin}\,\theta = \frac{\text{Max. } A - \text{Min. } E}{\text{Nominal } D}$$

Angle θ must be less than the tolerance for angular misalignment permitted on the part drawing. In some cases this tolerance is ± ½ deg. Selection of values of F as given above will usually insure that the diamond pin will maintain the piece in proper alignment in the fixture.

To provide easy placement of the part upon the locating pins, the effective height H of the pins should not exceed one-half of the pin diameter E. If the hole in the piece is chamfered on the side toward the locating face of the diamond pin, then the pin height H may be greater than $E/2$ by the depth of the chamfer.

TOOLING WAYS
Locates Points in Space



Principal dimensions and nomenclature of a tooling ways installation are indicated. The maximum length is 60 ft., the maximum height is 5 ft., 11 in., and the distance between longitudinal straightedges is 9 ft., 1 in. A cross-section of the installation is shown

THE "TOOLING WAYS" is an economical application of the principles of the master tooling dock, whose development by Leland A. Bryant at Consolidated Vultee Aircraft Corporation was first announced in these pages last year. Its initial cost is approximately half that of a master tooling dock, and it can be used in constructing small mock-ups, jig boring tooling plates, and setting up panel jigs or fixtures.

Like the tooling dock, the tooling ways enables workmen to find exact points in space by positioning a series of straightedges with proper relationship to one another. There are two fixed longitudinal straightedges to represent length dimensions or station lines; two movable vertical straightedges to represent height dimensions or water lines; and one movable transverse straightedge to represent width dimensions or buttock lines.

The longitudinal straightedges are held in a horizontal position by means of a steel supporting structure, which is fastened to the floor with bolts, and micrometric adjusting screws make it possible to align these members in true parallel relationship by means of electrically energized wires, an electronic mercury level and master gages. Each vertical straightedge comprises one side of an angle block, which may be moved to any desired position on either longitudinal straightedge; and the transverse straightedge is an individual member, which may be positioned at any height on the vertical straightedges. Grid line locations are denoted by the centers of 0.500 in. diameter holes, which are evenly spaced in a single side of each straightedge; and T slots, which run the length of each straightedge, make it possible to clamp required location fittings in place by means of "T" bolts.

Operating on the same principle as the master dock, the tooling ways can be used in making small and accurate mock-ups, and for light planes and car structures

Either strip templets or microbar-type location gages can be used to provide dimensional control for

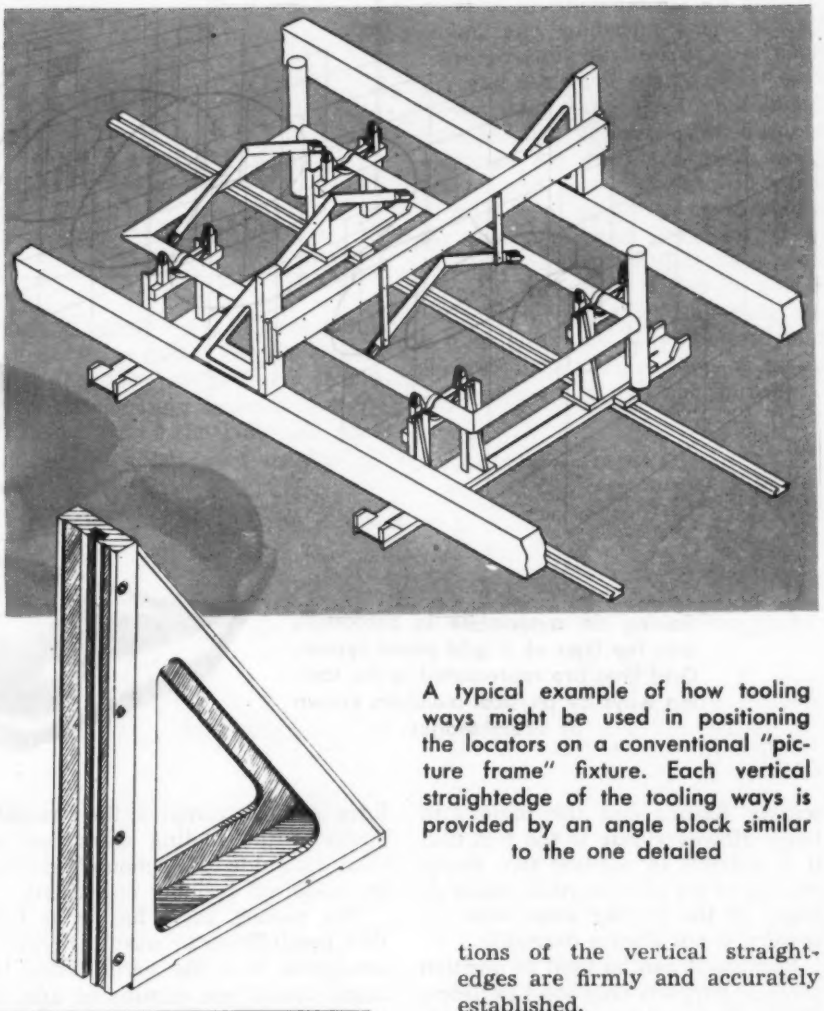
establishing the positions of the movable straightedges. When speed alone is the most essential tooling requirement, the microbar is used; but, when strict parts interchangeability is necessary, or when a number of duplicate jigs or fixtures must be produced, strip templets are preferable.

For ordinary positioning operations, only ten simple steps are required to utilize the tooling ways. They are:

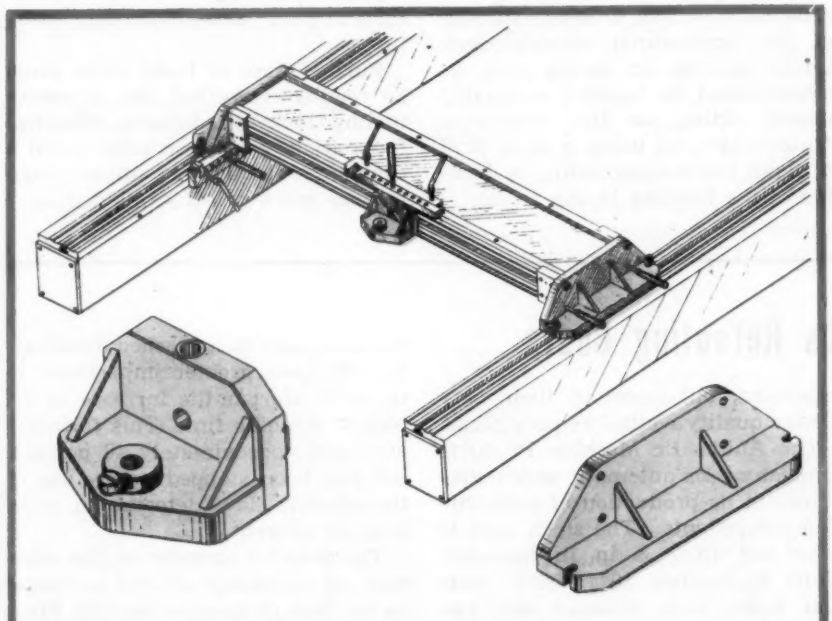
1. A jig or fixture frame is moved into the area between the longitudinal straightedges.
2. The frame is positioned by means of loading rails on the floor and supporting devices attached thereto.
3. Strip templets are used to locate fittings, which will establish station locations when fastened to the T-slots of the longitudinal straightedges with appropriate bolts. (Note: the same strip templet is used for finding identical station locations on both longitudinal straightedges.)
4. The jig or fixture frame location is tool-proofed.
5. The angle blocks are moved to the fittings which establish the location of the first station on the longitudinal straightedges; and, when the blocks have been attached to the fittings, the positions of the vertical straightedges are firmly and accurately established.
6. A strip templet is used to find water line locations, so that fittings may be positioned on the vertical straightedges (by means of T-bolts in the corresponding slots), and the transverse straightedge is fastened to the vertical straightedge fittings.
7. A strip templet is used to find a butt-line location on the transverse straightedge, and at this point a "dummy locator" is positioned to establish the third dimension in space.
8. A jig or fixture locator is positioned on the dummy locator.
9. The entire set-up is tool-proofed.
10. The locator is mated with the jig or fixture frame by pouring molten Cerromatrix (or equivalent material) into a pot which is attached to the frame so as to surround the locator base.

The last six steps are repeated at each following station until the jig or fixture is complete.

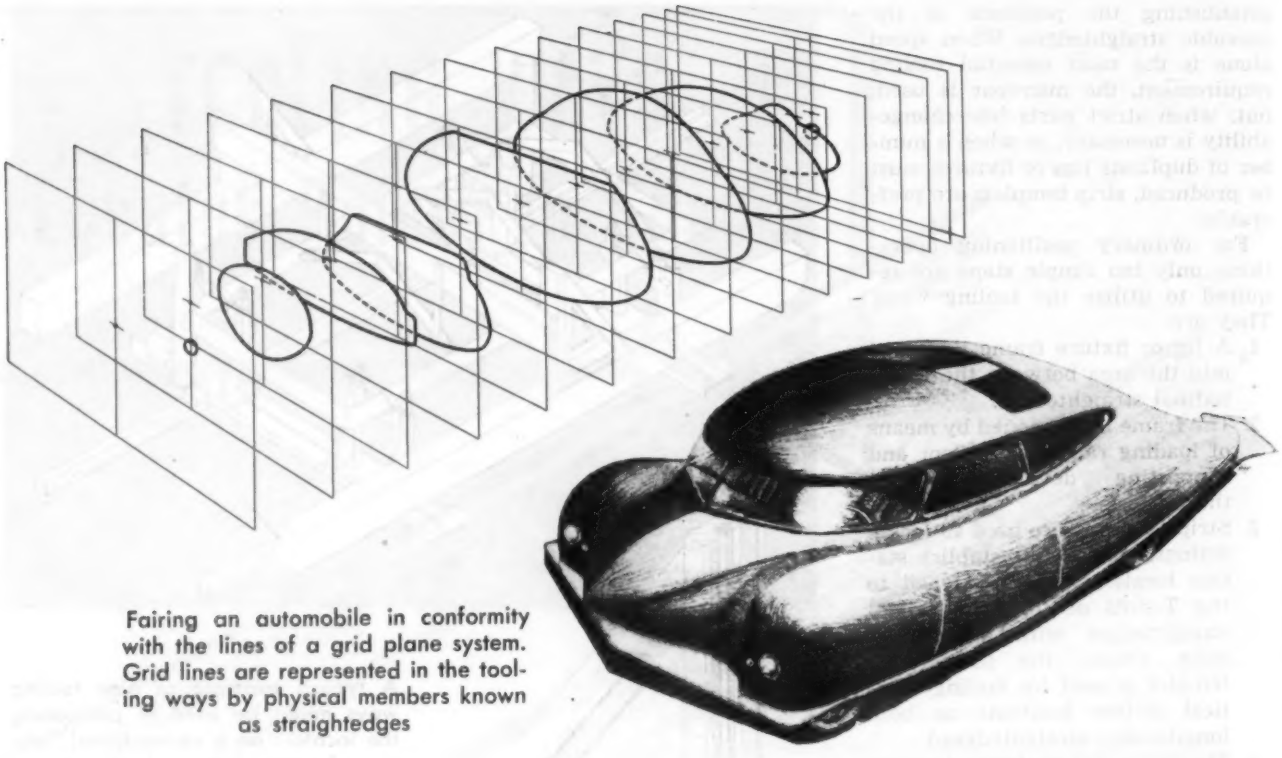
An index templet can be used in positioning contour locators in the third dimension, and to establish the relationship between tooling holes in each part to be located in the as-



A typical example of how tooling ways might be used in positioning the locators on a conventional "picture frame" fixture. Each vertical straightedge of the tooling ways is provided by an angle block similar to the one detailed



When angle blocks are eliminated and the transversal is used to locate stations on the longitudinal straightedges, the tooling ways perform similar to a jig borer. Actual drilling or boring can be accomplished by locating a suitably bushed fitting on the transverse straightedge and using a table drill or boring head to make holes conforming to the location of the drill bushing in the fitting



Fairing an automobile in conformity with the lines of a grid plane system. Grid lines are represented in the tooling ways by physical members known as straightedges

sembly fixture and the basic grid lines. However, due to the fact that it is difficult to position two transversals on the short vertical straightedges of the tooling ways, this accessory is not always desirable.

Because it can be used to position contour templets on a steel skeleton, the tooling ways will also greatly facilitate the process of constructing small and accurate mock-ups. When the templets have been positioned, the individual contour model can be completed by covering the structure with reinforcing mesh and fairing in with hard gypsum; and, if the lines layout is complex, the straightedges of the tooling ways can be used to guide the "mouse" during the required scribing operations.

The tooling ways has even further possibilities because it becomes analogous to a jig borer when its angle blocks are eliminated and its transversal is used to locate stations on its longitudinal straightedges. Actual drilling or boring may be accomplished by locating a suitably bushed fitting on the transverse straightedge and using a table drill to make holes conforming to location of the bushing in the fitting.

Because of the inexpensive nature of its foundation, the tooling ways will not retain extremely accurate straightedge settings for extended periods of time like a master tooling dock. However, its facilities should be entirely adequate for the assembly tooling required in building light airplane and automobile structures.

Further, one of these units could be readily converted into a master tooling dock by adding a "floating" foundation, a superstructure, and a conventional quota of upper longitudinal and vertical straightedges.

Electric Detector Curbs Retooling Costs

A PRODUCTION BOTTLENECK in turning out brass ammunition components was cleared by the Automatic Machine Products Company through installation of an electric detector for inspection of raw stock. Savings of $6,000 monthly in retooling costs was cited by the company as topping the list of advantages offered by the inspection device.

Produced by Sperry Products, Inc., the detector locates and indicates flaws in ferrous and non-ferrous materials and can be applied to welded or seamless tubing and bar stock. A sensitivity control permits manufacturers to avoid unnecessary rejections, but maintain their particular quality control requirements.

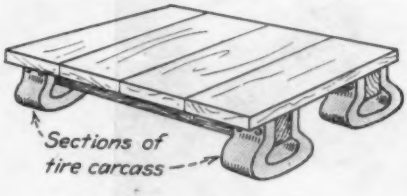
The Automatic Machine Products Company uses automatic screw machines in its production of ammunition components. The stock used is brass rod up to ⅝ in. in diameter. Until September 1944, hard spots and flaws, both internal and external, created tool breakage sufficient to cause machine stoppages averaging ten times monthly. Retooling costs were high.

Since installation of an electric detector, tool breakage attributed to defective stock in process has been completely eliminated. Retooling costs have been slashed drastically. Of even greater importance to the war effort is the increase in effective machine time. This formerly averaged approximately 40 percent, but has been stepped up by use of the electric flaw detector to more than 70 percent.

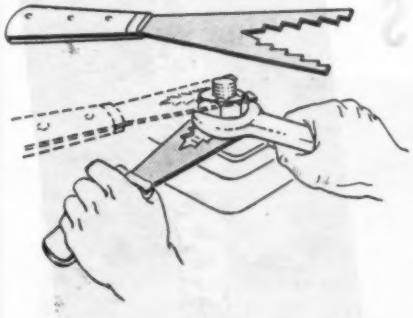
The detector operates on the principle of resistance offered by metal to the flow of electric current. Electric current flows through the bar stock or tubing. Flawless material does not change the current flow, but any defect, such as a seam, crack or inclusion, causes a change in the current. These current changes are translated into indications of the size and location of the defects.

Short Cuts
FOR THE SMALL SHOP

BY A. H WAYCHOFF

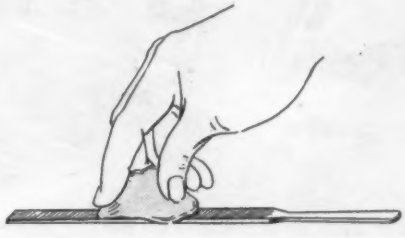


SAFETY STOOLS for electrician's use are more durable if the insulating feet are made from pieces of old tire casing instead of ordinary glass or porcelain insulators. The latter are always getting broken, and dangerous electrical grounds, or leaks, can result. To make the stool platform, nail two 2 × 4 blocks to the underside. Then cut coverings for the blocks from thick-wall casings. Fasten the rubber covering on each leg with shingle nails driven sideways through the casing near the beads. The result is a stool with thick, dependable rubber insulation which will not break when the stool is thrown around carelessly.



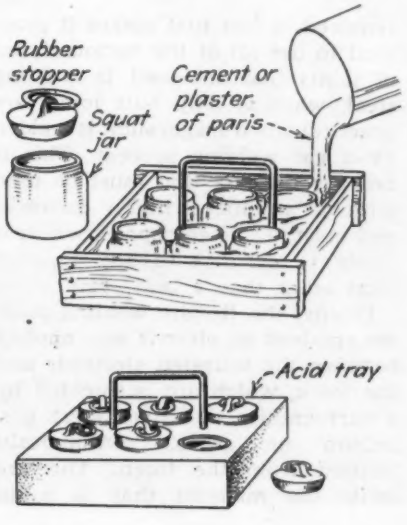
BOLTS THAT TURN with the nut can be held stationary with a V-jaw wrench made from a putty knife. Cut a rather long V-notch in the knife blade and file teeth on each side, the teeth pointing ahead. In use, push the V-notch of the blade against the body of the bolt, either below or above the nut and turn the nut with a wrench. This tool saves a lot of time when the bolt turns and there is no way of getting at the head, and avoids dismantling equipment.

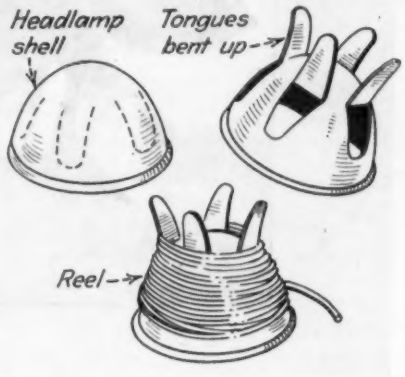
TOOLMAKERS' FILES, commonly called "Swiss files," can be cleaned with the soft, sticky gum that is sold for cleaning typewriter type. Take a wad of the gum and press on the file teeth, pick up and re-



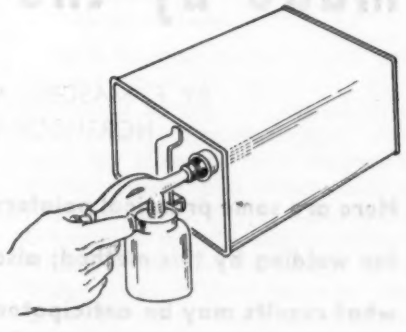
wad the gum, and apply again to the file. In this way, the sticky mass picks up the tiny metal particles that lodge in the file teeth, leaving them as clean as new. A few cents' worth of gum will keep ten dollars' worth of files in good condition.

SOLDERING ACID and flux jars needed for all sorts of soldering jobs can be assembled into a convenient kit. Eight jars makes a good number. These jars may contain such substances as: tallow for soldering lead; gallipoli oil for pewter and tin-antimony metals; sal ammoniac for gun metal and tinning the soldering iron; uncut acid for galvanized iron or zinc; cut acid for sheet iron; zinc chloride for gold or silver, and soldering paste of the non-corroding kind for work on copper and electrical goods. Squat cosmetic jars make good containers; rubber sink stoppers are durable closures. Set the jars in a wood frame and pour plaster of paris around them up to the level of the jar tops. A piece of ⅛ in. wire bedded in the plaster will make a good handle. The result will be a useful kit, in which wanted chemicals are conveniently at hand, clean and free of dirt, but the whole is easily transported and will not tip over.

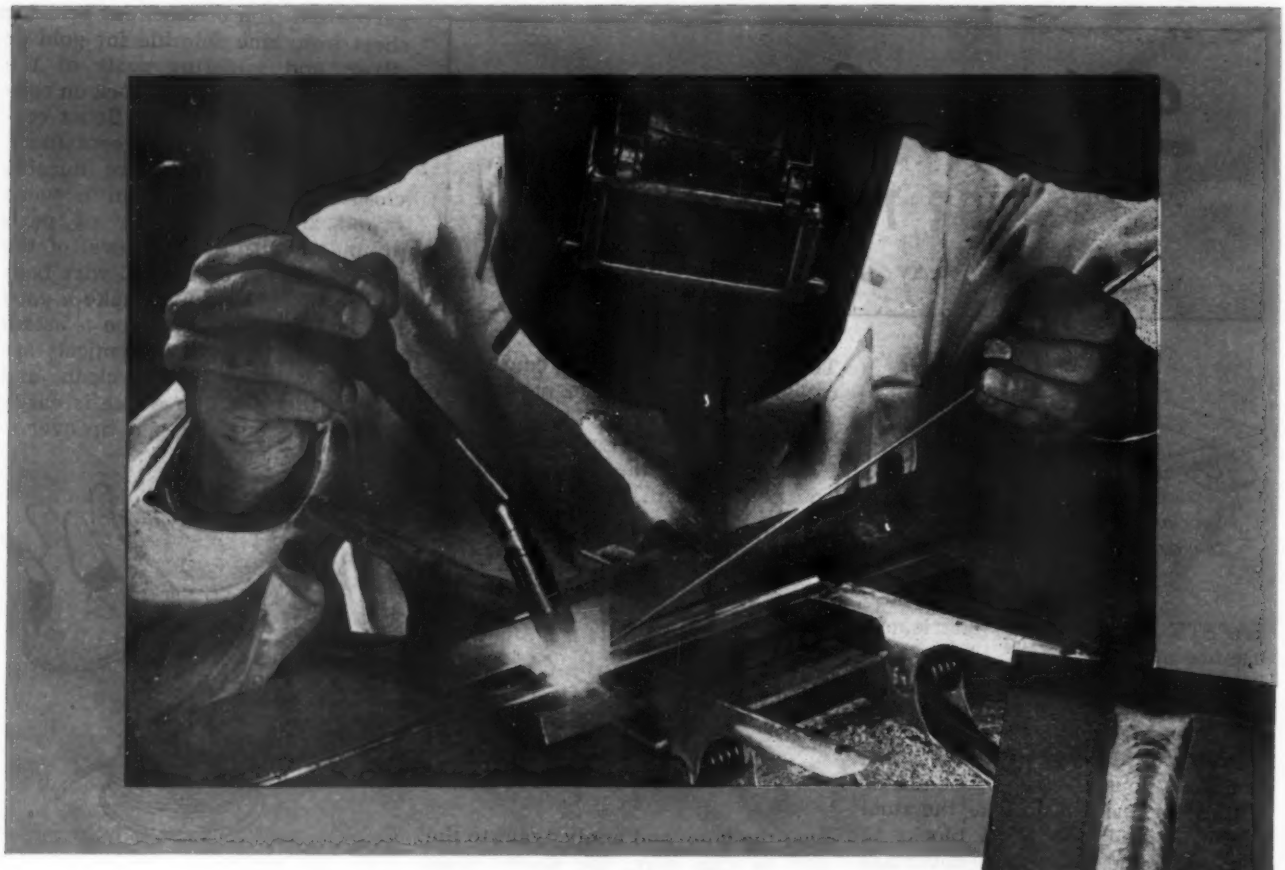




WIRE REELS, which serve also as a stand, are cheaply made from old headlight shells. Place the shell open end down on the bench and scribe four tongues about an inch wide. Cut the tongues along the scribe lines and bend them up as shown. A reel made like this is good for holding all sorts of fine wire and is fine for drying wet fishline.



AN EMPTY gallon can is useful when washing out spray guns. Merely insert the gun in the can and spray the solvent cleaner. The solvent is caught and can be used several times for cleaning the gun; dangerous fumes are not spread throughout the shop. Moreover, solvent is expensive. When it has picked up color after several gun-cleaning operations, use the solvent as thinner in dark-colored pigments. This idea cuts painting costs.



Good Welds in Magnesium Made by the Heliarc Process

BY F. MASDEO, WELDING ENGINEER,
NORTHROP AIRCRAFT, INC.

Here are some practical pointers for welding by this method; also what results may be anticipated

WELDING of magnesium alloys by the Heliarc process, as developed and applied by Northrop Aircraft, Inc., has made possible some revolutionary changes in the structure of aircraft, lowering weight and improving performance.

The Heliarc process, the first satisfactory method of arc welding magnesium, has greatly broadened the field of applicability of this metal. With this process, no flux is required, a fact that makes it practical to use all of the various types of joints that are used in welding steel, whereas only butt joints are practical when magnesium is welded by a gas welding process. This is because the flux that must be used with gas welding is highly corrosive and must not be entrapped, which is likely to occur with any type of joint other than a butt joint.

Briefly, the Heliarc welding process employs an electric arc, applied between the tungsten electrode and the work, which arc is shielded by a surrounding sheath of inert gas, helium or argon, continuously emitted from the torch. The arc melts the material that is being

The upper weld, made by the Heliarc process, and the lower one, made without helium, demonstrate the beneficial effect of the protective sheath of inert gas

welded, and the inert gas prevents oxidation, making the use of a flux unnecessary.

Speaking generally, all magnesium alloys that are normally available in rolled shapes may be arc welded successfully, over a broad range of variations in such factors as current, speed and filler rod.

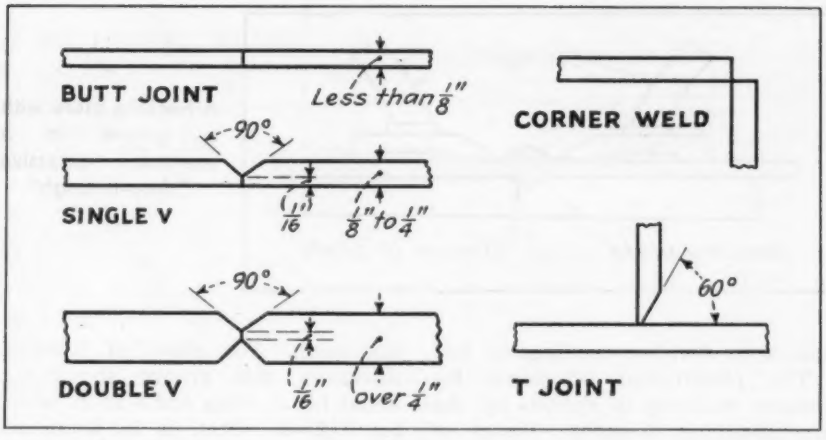
Specifically, the weldability of various magnesium alloys depends, largely, on their zinc content. Alloys that are high in zinc tend to be hot-short, and care must be taken in their welding to prevent incipient fusion and cracking. To some extent, a higher aluminum content counters the influence of the zinc as, for example, in the case of Dowmetal "J", which is the accepted standard, all-purpose alloy for Heliarc welding. Alloy "M", which is high in manganese, is of somewhat limited applicability for welding; it is lower in strength and has rather poor welding properties because of its narrow melting range and its high melting point. Also, electric current and the rate of travel are more critical with the "M" alloy than with those that contain aluminum and zinc, such as "FS" or "J", and slightly more current is required to weld material of the same thickness.

Cast metal, such as Dowmetal "H" or "C", is more difficult to weld than the rolled alloys because of porosity, the larger grains and the large globules between the grains. Best results are obtained by using single pass stringer beads, completing the weld in one pass.

Except for the inert gas, usually helium, and the special welding torch (shown in use in the photograph herewith), no unusual equipment is required for Heliarc welding. A standard d.c. welding generator, with variable control, is satisfactory. For the lighter gages, a welder of 150-amp. capacity is used; higher capacities, for the heavier gages. A conventional welder's helmet, with a door lens, is used. Most welders use a No. 10 shade lens, although this depends on the individual and the type of work.

Magnesium is always welded with reverse polarity, with the electrode positive and the work negative. Straight polarity causes an unstable arc and excessive splatter.

Experience indicates that the Heliarc process is well suited to the use of automatic welding equipment, and where long welds and high speeds are required, the use of such equipment is indicated. Smooth and uniform welds, with high physical properties, are obtained with automatic equipment.



Thickness of sheet and type of weld determine the proper preparation of the joint

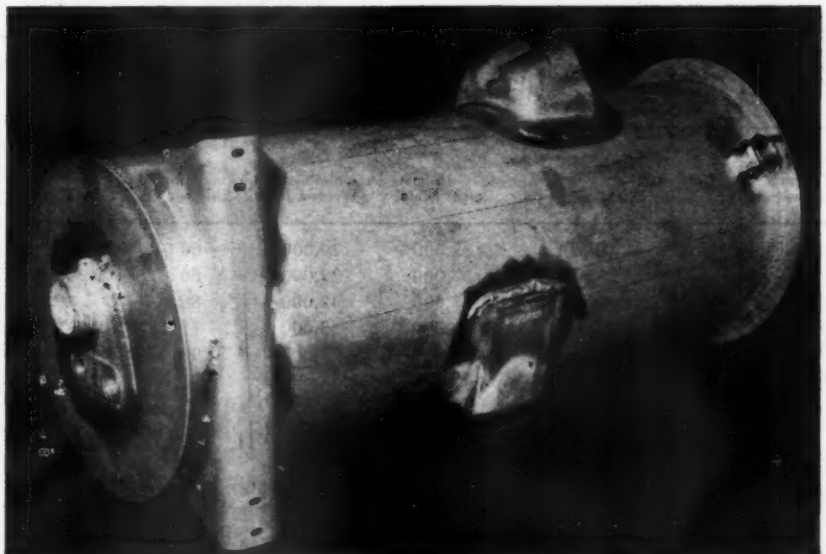
Helium gas is marketed in standard tanks, each containing, under a pressure of 2,000 lb. per sq. in., some 220 cu. ft. of gas, which is enough for 15 to 20 hours of welding with a medium size torch. High purity gas must be used to make a satisfactory weld. As purchased from the U. S. Government, helium is generally sufficiently pure.

Any gas impurities in excess of the amounts shown in the following table are likely to cause trouble:

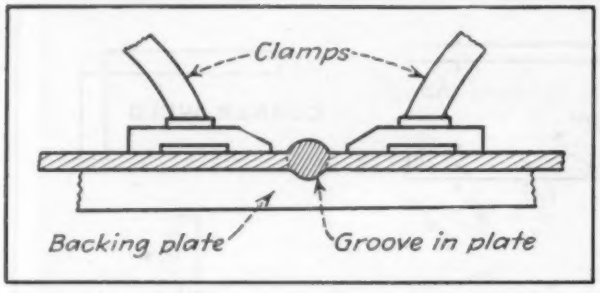
Helium	97.8%
Carbon dioxide	0.2
Nitrogen	1.6
Water	0.029
Hydrogen	0.2
Hydrocarbons	Nil

Each impurity has a specific deleterious effect. Water vapor is decomposed by the arc, releasing hydrogen and oxygen. Oxygen reacts with the metal to form magnesium oxide, causing poor fusion and inclusions. Hydrogen is absorbed by the molten metal, causing porosity. Nitrogen reduces welding speed. Water vapor is likely to cause trouble when the pressure in the helium tank drops below 50 lb. per sq. in., and in such cases the remaining gas should be passed through a drying agent such as magnesium perchlorate, or should be discarded.

A low pressure regulator, calibrated in ounces, with a standard hydrogen or oxygen gage, may be used to control the discharge pressure of the helium, but an oxygen regulator of the therapy type is more satisfactory. The reading of this regulator, which is in liters, may be converted to cubic feet per



A tank assembly of welded magnesium shows the clean joints which are obtainable



A backing plate with a groove in it prevents excessive "drop-through"

minute by dividing readings by ten.

The preparation of joints for Heliarc welding is shown by the accompanying sketches. Pieces of sheet up to 0.125 in. thick are usually butted together square. Good fit-up is important, especially with light material, to prevent distortion. Butt joints in thicknesses from 0.125 to 0.25 in. should be beveled to a 90 deg. included angle. The V should not extend completely through the material; a root face of about 1/16 in. should be left. Butt joints of more than 0.25 in. thickness should be given a double V.

Backing Plate Is Grooved

A backing plate, as shown by the sketch, is sometimes necessary or advantageous to prevent excessive drop-down of the metal, and to help hold parts in line. If such a plate is not used, the weld metal being allowed to drop through freely to obtain complete junction, good fit-up is most important. If a backing plate is used, it should have a small groove directly under the seam. This groove prevents excessive drop-down and casts a smooth bead of weld metal on the under side of the seam. For sheet of 0.064-in. thickness, this groove should be about 1/6 in. deep and 3/16 in. wide; for 0.125-in. sheet, ⅛ in. deep and ¼ in. wide.

Before welding, all paint, coatings, oxides, grease or other foreign matter must be removed from the welding surface. After-welding porosity is usually caused by improper or insufficient cleaning. Oil and grease should be removed with a solvent such as carbon tetrachloride. Shearing leaves an oil film on the edge of the sheet, which should always be removed. To remove oxides or chemicals, a hand or rotary brush, with wire of 0.003 to 0.006 in. is recommended, although steel wool, filing or grinding may be used. The sheared edge of a sheet on which welding is to be done should always be cleaned by one of these methods to remove metal fractured in shearing.

Good Cleaning Essential

Cleaning should extend to an area of approximately one inch along the seam that is to be welded so as to prevent any fumes that may be liberated by the heat from causing porosity and inclusions. The welding rod should be cleaned, and particularly, magnesium oxide coating should be removed with steel wool before welding. Thorough cleanliness throughout is essential to good welding.

Generally, welding jigs for use with magnesium, to hold the parts in alignment and reduce warpage, are of conventional design. Expansion and contraction should be allowed for, and the design should be planned to give the operator ready access to seams and joints. Steel or copper jigs or backing plates may be used, but there are some advantages in the use of magnesium also for jigs, warpage and stresses being minimized both during welding and during the after-welding treatments.

Advantages of Preheating

Preheating the parts to be welded also helps to reduce warpage and residual stresses, and cracking. It also permits greater welding speed and lowers the amount of electric current required. A further advantage of preheating is that the cooling rate is lower and the weld zone returns to a temperature at which it has greater tensile strength before it is subjected to extreme cooling stresses. Preheat temperature should be in the range of 200 to 400 F. Preheated jigs are advantageous, also.

Generally, a filler rod of the same analysis as the material being welded should be used, although it has been found that rod of Dowmetal J-1 is best for welding alloys of that same general type; it is stronger and lessens cracking.

SELECTION AND REGULATION OF HELIARC EQUIPMENT

Thickness Inches	Current Amps.	Filler Rod Diameter	Helium Flow Cu. Ft./ Min.	Helium Pressure Oz./Sq. In.	Tungsten Diameter
0.030	20	1/16	0.3	6	1/32
0.040	30	1/16	0.3	6	1/32
0.050	35	3/32	0.3	6	1/8
0.060	45	3/32	0.3	6	1/8
0.070	55	1/8	0.3	6	3/16
0.080	60	1/8	0.3	6	3/16
0.090	65	1/8	0.3	6	3/16
0.100	70	1/8	0.3	6	3/16
0.125	75	1/8	0.3	6	3/16
0.150	80	3/32	0.3	6	3/16
0.200	90	3/32	0.5	12	1/4
0.250	100	3/32	0.5	12	1/4
0.500	115	3/32	0.5	12	1/4
1.000	130	3/32	0.5	12	1/4

MECHANICAL PROPERTIES

Dow Metal Alloy	Form	Ultimate Strength PSI Parent Metal	Ultimate Strength PSI Welded Joint	Average Joint Efficiency%	H.T. After Welding
Ma	Sheet	33,000	20,000	60	None
Mh	Sheet	37,000	22,000	60	"
FS-1a	Sheet	37,000	32,000	86	"
FS-1h	Sheet	43,000	33,000	77	"
J-1a	Sheet	42,000	41,000	98	"
J-1h	Sheet	45,000	42,000	93	"
FS-1	Extrusion	40,000	34,000	85	"
J-1	Extrusion	45,000	37,000	82	"
O-1	Extrusion	49,000	35,000	71	"
H-1	Casting	29,000	26,000	89	As Cast
		40,000	32,000	80	H.T.
		40,000	34,000	85	H.T.A.
C	Casting	24,000	24,000	100	As Cast
		40,000	32,000	80	H.T.
		40,000	34,000	85	H.T.A.

RECOMMENDED STRESS RELIEVING TREATMENT FOR HELIARC WELDED JOINTS		
Dow Metal Alloy	Temperature °F. ±10°	Time at Temperature
FS-1a	500	15 Minutes
FS-1h	265	1 Hour
Ma	500	15 Minutes
Mh	400	1 Hour
J-1a	500	15 Minutes
J-1h	400	1 Hour

STRENGTHS OF HELIARC WELDED JOINTS IN LB. PER IN. OF SEAM					
Thickness	Butt Welds	Single Lap Weld	Double Lap Weld	Edge Weld	Tee Welds
0.064	2,700	900	2,200	400	1,500
0.091	3,800	1,200	3,000	750	1,800
0.125	5,300	1,500	3,800	1,100	2,200
0.187	8,000	2,000	5,200	1,600	3,000
0.250	10,500	2,700	7,000	2,300	3,500

FATIGUE STRENGTH				
Alloy	Thickness	Type Test	Fatigue Strength Lb./Sq. In.— 100,000,000 Vibrations Original Bars	Welded Bar
J	0.064	Krause	13,000	12,000
J	0.156	Krause	12,000	11,000
C	0.500	R. R. Moore	9,000	11,500
C	0.500	R. R. Moore	10,000	12,500
C	0.500	R. R. Moore	10,000	13,500

The actual operation of Heliarc welding is relatively simple and conventional, with only a few special requirements. The arc should be struck by lightly brushing the electrode on the magnesium surface, drawing it back quickly to the desired length of arc. A short arc is desirable, the electrode being held close to the welding surface; a long arc allows the formation of oxides and inclusions.

The helium cup should be held close to the work, protecting the molten metal by concentrating the gas around the electrode. The filler rod is fed in the usual manner. For best results, make as few stops as possible. Wire brush the weld before continuing after a stop. If multiple passes are used on heavy sections each successive weld bead should be wire brushed. Upon completion of a bead, the helium should be kept flowing for a short time to prevent oxidation of the tungsten electrode.

Warpage Easily Corrected

After-welding treatment consists of reduction of warpage, stress relief and finishing. Warpage is corrected most easily by heating the part to the temperature recommended for stress relief (see table) and pressing or hammering lightly with a leather or wooden mallet. Often a warped assembly will be straightened by reclamping it in the jig, the entire assemblage being raised to stress relief temperature in a furnace. This procedure should also be used when possible for stress relief even though parts are not warped. In this connection, the advantage of using magnesium jigs, as previously said, is apparent. Parts are cooled in still air, in the jig.

The residual stresses which may be set up by welding, for whose relief the indicated heat-treatment is required, are in and adjacent to the weld, in a longitudinal direction, and are of the order of 1,000 to 15,000 lb. per sq. in.

Most everything that has been said about the welding of sheet or plate stock is also applicable to the welding of castings of magnesium alloy. They must be cleaned the same way, and the filler rod must be of the same composition as the castings themselves. Cracks must be ground or chipped to an included angle of 90 deg., and holes must be countersunk to give complete access to the bottom.

Weld Castings Continuously

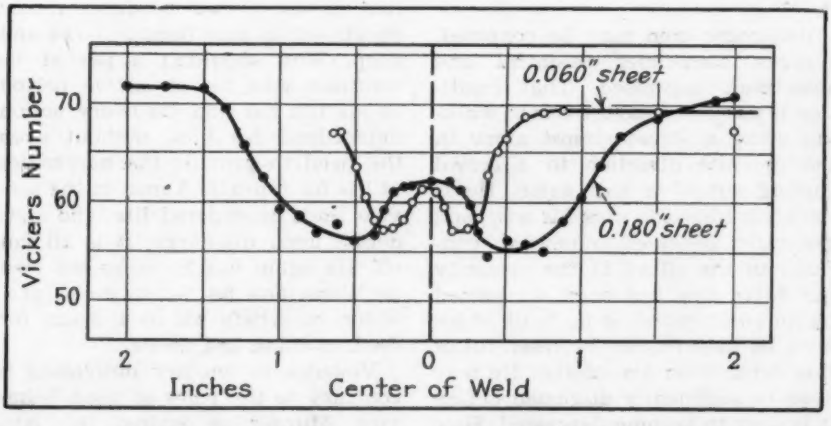
Preheating is not required for small defects, but for large or complicated operations the entire casting should be pre-heated—to 500-600 F. for small castings, and to 700 F. for larger ones. The welding is best done in one continuous operation to prevent stresses, and weld reinforcement should be allowed to remain, if possible, although it may be removed if necessary. If a casting has been heat-treated before being welded or repaired, it may be necessary to heat-treat it again.

Finishing, after welding, is a simple operation with Heliarc welding because no flux is used. The welds should be wire brushed, as described for before-welding cleaning, and any grinding or filing required should be done. That completed, the usual chemical treatment or painting may be done.

With some modification, most standard procedures for the inspection of welds may be applied to Heliarc welds. They must be checked for under-cutting, cracks, porosity, overlap, craters and inclusions.

No especial fire hazard exists in Heliarc welding magnesium. The very technique of the process requires the exclusion of oxygen from the weld pool, the curtain of inert gas acting in the same manner as molten flux in gas welding. If, however, it is necessary to grind or otherwise remove weld beads or excess penetration, it should be remembered that magnesium in the form so produced is highly combustible, and it should be carefully exhausted into a container filled with water.

Acknowledgement: "Arc Welding of Magnesium Alloys," by W. S. Loose & A. R. Orban, The Welding Journal 21 (12), Research Supplement 598-s to 607-s (1942).



A hardness survey of Heliarc welds in two thicknesses of magnesium sheet discloses variations existing from the center of the weld

THE FOREMAN CAN HELP

The Returning Service Man

BY FRANK WARREN, EAST SPRINGFIELD PLANT,
WESTINGHOUSE ELECTRIC CORPORATION

It is the foreman's privilege to take a major part in assisting veterans to readjust themselves to useful work and normal living

FOREMEN are going to have to do another big job. Discharges from the armed forces are beginning to make the problem of discharged veterans in industry a crucial one. As the war progresses, more and more men will return to whom industry, in particular, and the country, as a whole, owe a great obligation.

Certainly there is no foreman who is not anxious to do everything in his power to meet this obligation. Desire to do the job, however, is not adequate equipment to do it. In order to meet any obligation he must know its nature and how to handle it.

Returning men may be confused, restless, sometimes resentful and sometimes depressed. That condition is natural. Imagine a man walking along a street almost alone in the opposite direction to a crowd coming out of a ball game. He is buffeted, forced to pick his way, and generally becomes somewhat confused in the effort. If the necessity for doing this has been occasioned by an event which is no fault of his own, he may readily be resentful of this demand on his efforts. He may even be sufficiently disgusted before it is over to become depressed. How like that situation, but much more accentuated, is that faced by the young man of military age who today finds himself coming out of the armed services when many of his age are heading in.

This straining against the direction of the crowd produces minor upsets which may become large and deep. Why shouldn't a person be confused who for an active period of his life has had his every action determined for him, without even the need to provide the necessities of life for himself. A man in the service leads an ordered life, and suddenly, upon discharge, it is all cut off. He again has to make his own decisions, and he has to make provision to satisfy his own needs for food, clothing and shelter.

Violence to another individual is contrary to the rules of good behavior. Murder is against the law, which prescribes for one proved guilty an extreme penalty. Millions of men were picked from these precepts of civilization and have been taught how to kill by every means known to man. They are encouraged to hate. Suddenly this is all stopped, and they again must go back to the rules of living which are the exact opposite of what they have so recently been taught to practice. Is there any wonder that they are confused?

Many of these men coming back are going to have some physical or nervous limitation. In some instances these limitations were incurred in performance of duty. In other instances they were present all the time but were uncovered by the rigorous requirements which are a part of life in the armed forces. It is distressing to anyone to find that he has a physical limitation of which he was not aware.

When one is away on a vacation for a week or two, it takes several days to settle down to the job when he gets back. The sight of a passenger train or a Canadian camping picture is sufficient to give him an urge to be on the move again. It creates an unsettled and restless feeling.

Let's exaggerate that picture. A veteran comes back who has traveled to places which he had little

reason to believe he would ever see. If it takes a week to settle down from a two weeks' vacation, how long will it take him to settle down from an eighteen months' trip to the South Pacific? His change has been longer, more radical than any vacation. It is natural, therefore, to expect that a man returning from the service in perfect health will have spells for a period of months when it is hard for him to attach his attention to the job at hand.

There is the case of a returned sailor, discharged after being wounded in action, who applied for a job and started as a learner on a machine. He made excellent progress and his production was fine. However, by the second week, after working a couple of hours he would walk away from the machine and disappear for an hour. But he would come back and tear into it again. This went on for three weeks, and by the time the foreman had started to realize that he had a problem here, the boy walked out and just kept on going. They never saw him again.

This typical problem shows the need for observation and getting in on it at the earliest moment. Some of these boys are in sound health both mentally and physically, which makes them an easily adaptable group.

A man is *not handicapped* if he is fitted to a job within the limits of his physical abilities. If a blind man is given a job that he can do perfectly well without sight, that man is not handicapped in that spot. The same pertains to many other physical limitations. It is extremely interesting to see what these people can do and how immeasurably *much the job does for them.* The foreman can materially aid by carefully analyzing his jobs to determine which ones could be filled by persons having some physical limitations.

Handicapped persons are not necessarily, in fact are rarely, liabilities to a company employing them. They are capable of doing skillfully and speedily a job that must be done and therefore pull their weight in the economic picture. The more ingenuity used in picking jobs that can be filled by such people, the more they can be made economically valuable to us.

Henry Ford made a survey in 1920 of the percentage of physically disabled people in the communities where he had plants. He found this percentage to be ten percent, and ever since his employment policy has been to hire ten percent physically handicapped persons. This ten

HOW THE FOREMAN CAN HELP HANDICAPPED VETERANS

1 Treat all these men as though they were normal human beings. There is nothing which the returned veteran is so anxious to do as to return to an unobtrusive place in a civilian society.

2 Let them know you expect them to do a job. These men should not be coddled. If they have been properly fitted to a job within their capacities, the attitude of the foreman should be that they are expected to live up to the job just like any other individual.

3 Restrain any grief or pity you may feel toward them and keep from showing it. They don't want it.

4 Be tolerant, if at times a veteran is what we like to call temperamental. Perhaps this is only a phase of his readjustment.

5 Let him do jobs even when they seem a little difficult or awkward for him. It will give him self-confidence and satisfaction.

6 Recognize but never talk about his disability or experiences unless he initiates the subject.

7 Avoid staring at a disability.

8 It is natural to watch the functioning of an artificial limb but do not embarrass a user of one by your observation.

9 Avoid showing your knowledge of his experience which he knows is at best a second-hand knowledge. Above all, avoid trying to impress him with a war-wise attitude because it is going to sound false to him.

10 Observe closely but inconspicuously for unusual signs of fatigue or disturbance. Even the medical profession must draw many of their conclusions about these men from very minute signs of fatigue.

Don't try to tell the veteran how the war should be won nor complain to him about wartime living conditions

percent includes absolutely all forms of physical handicap. For instance, he has two men with no arms as toolcrib attendants. He has many with one arm, many with one hand, a great percentage who are blind, and many with one leg missing. One blind man can completely assemble a Ford engine.

At Camp Legion, a 600-acre farm, he has built an attractive barracks with recreational facilities. It is a branch of the Ford Trade School where new trades may be learned. Any veteran applying who is accepted may go to Camp Legion where he is paid $3 a day and sustenance. It is a convalescent camp. When a man feels ready to leave he owes no obligation to anyone. He may have learned a new trade and wishes to work at General Motors. This is perfectly permissible. The whole project is a wonderful opportunity for veterans to get new skills and regain their full health.

He Won a Bet

One man with his right side paralyzed through a service injury works on an arbor press. By using his paralyzed arm, he is restoring functions to those muscles. A 17-year-old sailor with one arm won a bet from one of the boys by grinding more small high-speed cutters in two hours with his one hand than anybody else in the school.

A man may have nervous disabilities apart from those received in the service. He comes back released as a psychoneurotic. He may even have been turned down for this cause. This word *"psychoneurotic"* is a perfectly good word which has recently been terribly misused. Perhaps the most important thing to realize with regard to people in this classification is that there is not necessarily anything wrong with them for industry. A man may have a nervous system entirely able to withstand the normal nervous strain of an industrial job. However, he may not have the extra resistance capable of withstanding the usual strain experienced in the armed services. After all, soldiering is a profession, and there are those who by disposition and either nervous or physical ability are not fitted for that particular profession. Such a person is no more to be discredited. He must simply accommodate his work to his ability. So long as he is treated in a perfectly natural way be probably will not give any trouble.

Men called for the draft and returned as nervously unfit for military service are often thought of as considerably impaired, but a year or two of observation of them on the job proves that they are thoroughly useful workmen and under industrial conditions show no signs of being different from other men.

Any man who has brains and imagination is a psychoneurotic to a *degree;* it is the degree that makes the difference. Without psychoneurotics in an organization there would be no production.

There will be cases, however, where men return from the service with nervous systems impaired by their experiences. They should be observed for signs of fatigue, despondency or some other manifestation of nervous strain. If instances recur that indicate a particular job may be hard on a man, the type of work should be changed to give him relief.

What was termed "shell shock" in the last war is being more properly called "battle fatigue" in this war. When some of these men have been under grueling physical strain for a period of time they may not be able to withstand nervously the effect of a heavy spell of shelling or bombing. Great strides have been made in the care of soldiers so affected by carrying their treatment right to the battle front. Many of them, after a short rest and proper care, return to front line fighting and a large percentage of them are kept in the service. It is those who have a need for prolonged treatment who are sent back.

Watch Changes in Attitude

The foreman must know something of what to expect from cases of this kind. If a man has been normally of one disposition, perhaps a happy appearing individual, and suddenly withdraws into himself with a distinct change of attitude or manner, he should be carefully observed and perhaps checked up. When these men withdraw into themselves, emotions are *starting* to build up which will lead to an explosion. The most common reaction of these people toward the event and the person who caused their blowup is a violent and sudden anger. There are further types of nervous afflictions which cause many such things as heart trouble, stomach ulcers and almost all ills common to man. The primary cause of these disabilities may not be an organic ailment but a nervous one. They do, however, have to be treated as heart cases and ulcer cases as the case may be. But the real job of the doctor is to rehabilitate their nerves. Doctors long experienced in veterans' hospitals tell us there is but one thing of which we may be absolutely certain, namely, that there is no set formula or set of symptoms to look for. Each case is always individual.

The foreman is going to have to work with the same tolerances in human relations that he is accustomed to use in his machine work. There must be accuracy and precision which will challenge the best he can give. The call on him is to treat entirely naturally a man whom he would be likely to set apart in his thinking as a person at least of unusual experiences. At the same time the foreman must be constantly on the alert for the slightest unusual sign of fatigue or pain that he may show. It is a tough job which no one can perform 100 percent perfectly.

Memories of combat experiences are bound to filter through the veteran's mind in his readjustment to civilian work

Foreign Standards for Metric Threads Vary in Many Details

BY JOHN GAILLARD, MECHANICAL ENGINEER, AMERICAN STANDARDS ASSOCIATION

Potential makers of goods for export should take into account that thread standards of metric countries are not in agreement upon tolerances, crest clearance and pitch-diameter progression

NUMEROUS QUESTIONS have been raised by American manufacturers concerning details of metric-thread systems used in various foreign countries. This is so for two reasons. First, many U. S. firms undertook manufacture of foreign equipment and materiel after hostilities commenced in Europe and their participation in these fields increased with expansion of Lend-Lease. Second, much postwar planning is being done by American concerns and they are interested in how variations in metric-thread systems will affect production plans for export goods. Undoubtedly additional firms will receive blueprints that require clarification of specifications. For example, if the threads must be produced within close limits to secure interchangeability or proper fitting of components, questions may arise about fits and other details. Or the manufacturer may wish to know what American thread will replace a metric thread in respect to pitch and thread depth.

It may seem strange that there is not complete uniformity among the metric-thread systems adopted by various European countries. For almost 50 years ago, there was established the "S I System" (from the French name "Système International"), or the "International System" of metric-threads. The truth is that international unification of metric-thread standards has gone a long way, but there are still a number of detail variations among the various national standards.

Before the war, national standards for metric-threads were established in 14 countries: Austria, Czechoslovakia, Denmark, Finland, France, Germany, Italy, Japan, Netherlands, Norway, Poland, Sweden, Switzerland and U.S.S.R. Also, a British War Emergency Standard for metric-threads was approved in 1943. These various standards will be discussed so that any manufacturer who has to produce metric threads, may know at once what standard will give him the necessary information. But they will be understood better if earlier standardization activities are reviewed.

Metric-thread systems have been proposed in Continental countries since 1848. Efforts toward international unification led in 1898 to a

Fig. 1—Basic profile of the "SI System" metric thread is shown by the heavy line. The maximum permissible crest clearance is H/16; if a rounded root form is used the crest clearance is equal to 0.05 pitch

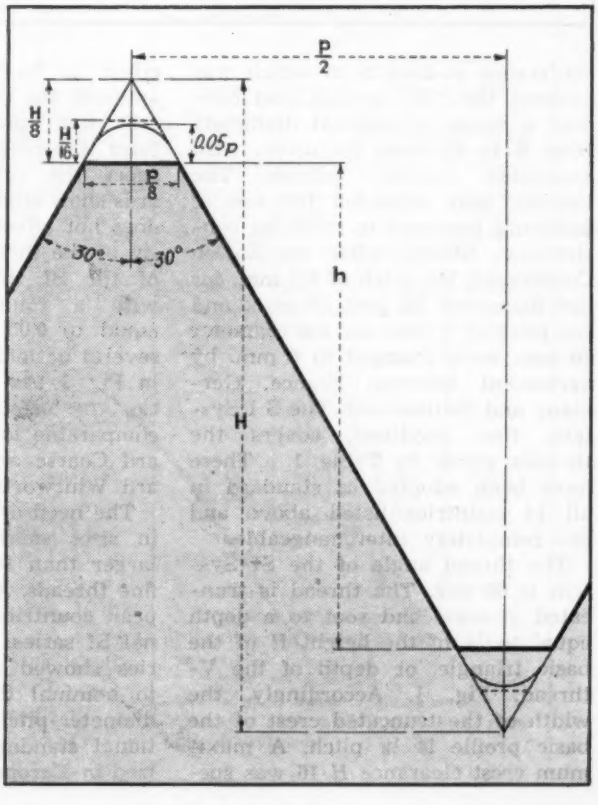


Table 1—International or "S I" System of Metric-Threads

(With modified pitches for 72-, 75- and 80-mm. diameters)

Nominal Dia.	Pitch mm.	Nominal Dia.	Pitch mm.	Nominal Dia.	Pitch mm.
6	1	20	2.5	48	5
7	1	22	2.5	52	5
8	1.25	24	3	56	5.5
9	1.25	27	3	60	5.5
10	1.5	30	3.5	64	6
11	1.5	33	3.5	68	6
12	1.75	36	4	72	6
14	2	39	4	76	6
16	2	42	4.5	80	6
18	2.5	45	4.5		

TABLE 2—INTERNATIONAL METRIC SCREW THREAD SERIES
(According to ISA Bulletin 26, September, 1940)

Nom. Dia. mm.	Pitch mm.			Nom. Dia. mm.	Pitch mm.					Nom. Dia. mm.	Pitch mm.				
	A	B	C		A	B	C	D	E		A	B	C	D	E
1	0.25	0.2		18	2.5	1.5	1			60	5.5	4	3	2	1.5
1.2	0.25	0.2		20	2.5	1.5	1			62		4	3	2	1.5
1.4	0.3	0.2		22	2.5	1.5	1			64	6	4	3	2	1.5
1.7	0.35	0.2		24	3	2	1.5	1		65		4	3	2	1.5
2	0.4	0.25		25		2	1.5	1		68	6	4	3	2	1.5
2.3	0.4	0.25		26		2	1.5	1		70		4	3	2	1.5
2.6	0.45	0.35		27	3	2	1.5	1		72	6	4	3	2	1.5
3	0.5	0.35		28		2	1.5	1		75		4	3	2	1.5
3.5	0.6	0.35		30	3.5	2	1.5	1		76	6	4	3	2	1.5
4	0.7	0.5		32		2	1.5	1		78		4	3	2	1.5
4.5	0.75	0.5		33	3.5	2	1.5	1		80	6	4	3	2	1.5
5	0.8	0.5		35		3	2	1.5	1	82		4	3	2	1.5
5.5	0.9	0.5		36	4	3	2	1.5	1	85(84)	6	4	3	2	1.5
6	1	0.75		38		3	2	1.5	1	88		4	3	2	1.5
7	1	0.75		39	4	3	2	1.5	1	90(89)	6	4	3	2	1.5
8	1.25	1	0.75	40		3	2	1.5	1	92		4	3	2	1.5
9	1.25	1	0.75	42	4.5	3	2	1.5	1	95(94)	6	4	3	2	1.5
10	1.5	1	0.75	45	4.5	3	2	1.5	1	98		4	3	2	1.5
11	1.5	1	0.75	48	5	3	2	1.5	1	100(99)	6	4	3	2	1.5
12	1.75	1.5	1	50		3	2	1.5	1	102		4	3	2	1.5
14	2	1.5	1	52	5	3	2	1.5	1	105(104)	6	4	3	2	1.5
15		1.5	1	55		4	3	2	1.5	108		4	3	2	1.5
16	2	1.5	1	58	5.5	4	3	2	1.5	110(109)	6	4	3	2	1.5
17		1.5	1	58		4	3	2	1.5	etc.		4	3	2	1.5

Diameters below 6 mm. In the diameter range from 1 to 5.5 mm., inclusive, the French national standard differs from ISA Series A, see Table 3.

Diameters above 80 mm. For Series A, ISA Bulletin 26 gives the diameter progression 5-0-5, from 85 to 150 mm., inclusive, as well as the progression 4-9-4, from 84 to 149 mm., inclusive (see values in parentheses). The progression 5-0-5 has been adopted in Denmark, Finland, France, Italy, Netherlands, Sweden, Switzerland and U.S.S.R. The progression 4-9-4 has been adopted in Czechoslovakia, Germany, Norway and Poland. For Series B to E, inclusive (Fine Threads), ISA Bulletin 26 gives the diameter progression 2-5-8-0, from 110 to 300 mm., inclusive.

conference at Zurich, at which was adopted the "SI" system that covered a range of nominal diameters from 6 to 80 mm., inclusive, with associated (coarse) pitches. The threads were intended for use as fastening purposes in machine construction. Shortly after the Zurich Conference, the pitch of 6.5 mm. for the diameters 72 and 76 mm. and the pitch of 7 mm. for the diameter 80 mm. were changed to 6 mm. by agreement between France, Germany and Switzerland. The S I System, thus modified, covers the threads given in Table 1. These have been adopted as standard in all 14 countries listed above and are completely interchangeable.

The thread angle of the SI System is 60 deg. The thread is truncated at crest and root to a depth equal to ⅛ of the height *H* of the basic triangle, or depth of the V-thread, Fig. 1. Accordingly, the width of the truncated crest of the basic profile is ⅛ pitch. A maximum crest clearance *H*/16 was specified, to be taken from the root opposite the crest. The form of the root was optional, but a rounded form was recommended. In this respect, the various national standards show slight differences, but this does not affect the interchangeability of the threads. The basic profile of the SI thread, in combination with a rounded crest clearance equal to 0.05 pitch, as adopted in several national standards, is shown in Fig. 1. As to diameter-pitch ratio, the original SI threads were comparable to the American Standard Coarse and the British Standard Whitworth threads.

The need of metric coarse threads in sizes smaller than 6 mm. and larger than 80 mm. and of metric fine threads, led a number of European countries to extend the original SI series. These additional series showed differences in respect to nominal diameters, pitches and diameter-pitch combinations. National standardizing bodies, organized in Europe during and after the first World War, made an effort to bring some order in these additional series. In 1926, the International Standards Association (ISA) was founded, and one of its first technical committees dealt with metric threads.

At a conference held in Copenhagen in 1931, this committee succeeded in getting agreement in principle on five recommended series of metric-threads, designated by the letters *A* to *E*. The ISA Bulletin 26, in which the recommended ISA Series are listed, was not published until September, 1940. See Table 2. The original series of SI coarse threads was extended to diameters as large as 600 mm. (about 24 in.), the pitch being 6 mm. for all sizes above 80 mm. Therefore, the term "coarse" threads was avoided and the original SI series, with its upward and downward extensions, was designated as "ISA Series *A*." However, ISA Bulletin 26 and the national standards set up in accordance with it, explicitly refer to the ISA Series *B* to *E*, inclusive, as Fine Threads.

To list the deviations from the ISA Series that occur in national standards would be more confusing than helpful. Those who have problems in this field will get a quicker answer by consulting the national standard involved. However, two of the more important differences in national practice should be mentioned. One is the deviation of the French national standard from the ISA Series in sizes below 6 mm. See Table 3.

The other difference in national practice concerns the progression of the nominal diameters above 80 mm. in ISA Series A. Most countries (Denmark, Finland, France, Italy, Netherlands, Sweden, Switzerland and U.S.S.R.) use the progression 85, 90, 95, and so on, briefly designated as the 5-0-5 progression. Other countries (Czechoslovakia, Germany, Norway and Poland) adopted the progression 84, 89, 94, and so on, called the 4-9-4 progression. In Germany, all diameters up to 200 mm. that end in zero or 5, belong to the national standard series of diameters. From 200 to 500 mm., inclusive, German standard diameters increase by 10 mm. In the ISA Fine Thread Series *B* to *E*, the diameter progression from 110 mm. upward is 102, 105, 108, and so on, which is called the 0-2-5-8 progression.

The British Standards Institution published a war standard for metric screw threads (BS 1095-1943),

but the standard states that metric-threads should be used only "when called for on established designs and where interchageability with existing parts is imperative." The British Standard covers the metric-threads of ISA Series *A* in sizes from 6 to 80 mm., the upward extension with the 5-0-5 progression (85, 90, 95,); and the downward extension from 1 to 5.5 mm. It also gives the French standard series of sizes from 1 to 5.5 mm. (Table 3).

In respect to crest clearance, there are differences between the national standards. The French standard merely specifies the maximum value (*H*/16) permitted in the SI System and recommends the use of a rounded root.

A nominal crest clearance, 0.05 pitch, has been adopted in the following countries: Austria, Czechoslovakia, Finland, Italy, Netherlands, Norway, Poland and Switzerland. The value, 0.045 pitch, has been adopted in Denmark, Germany, Japan and U.S.S.R. It appears to have originated long ago in Germany, when a crest clearance equal to 1/19 pitch (or about 0.04558 pitch) was adopted. In Sweden, no specific value for the crest clearance is recommended.

The SI System did not include specifications for the limiting dimensions of screw and nut. Therefore, the choice of the fit in terms of pitch-diameter tolerances and, if desired, an allowance (as applied in the American Standard Class 1 fit), was left to the designer. So far, the only countries where national specifications for metric-thread limits have been adopted are Germany, Great Britain and U.S.S.R. The French national standard says merely that the nut is basic; that a pitch diameter allowance (if any) shall be taken in the screw; and that the designer should decide on the proper values of the tolerances and allowance.

Table 3—French National Standard Metric-Threads (S I Form) Nominal Diameters 1 to 5.5 mm., inclusive

Nom Dia. mm.	Pitch mm.	Nom. Dia. mm.	Pitch mm.
1	0.25	2.5	0.45
1.2	0.25	3	0.6
1.4	0.3	(3.5)	0.6
1.6	0.3	4	0.75
1.8	0.4	(4.5)	0.75
2	0.4	5	0.9
2.2	0.45	(5.5)	0.9

Note Use of the sizes in parentheses should be avoided, if possible.

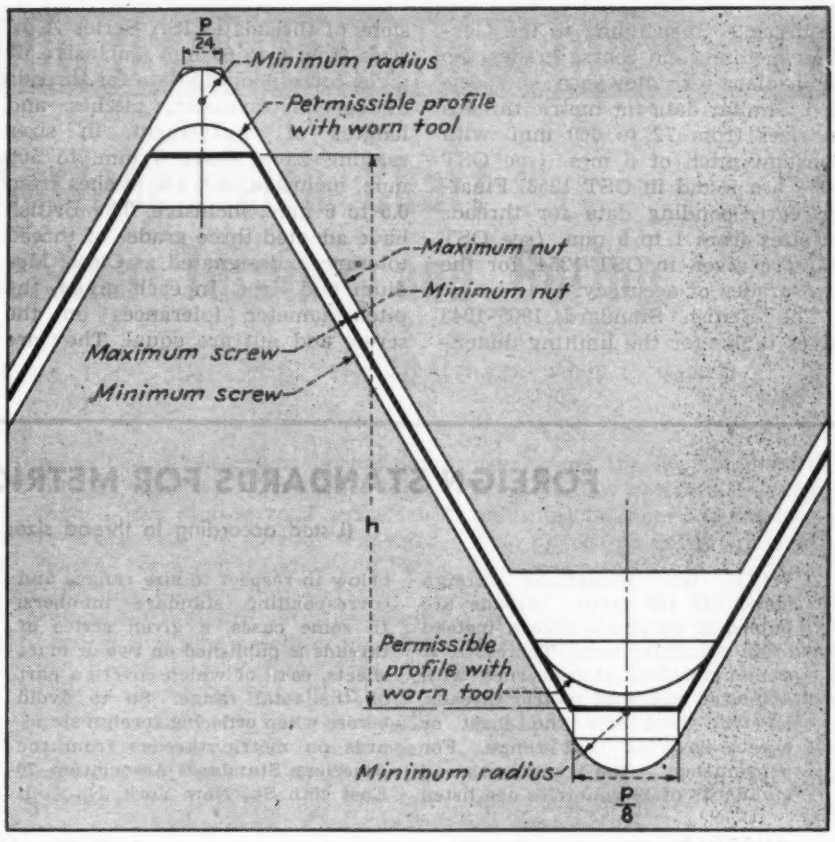


Fig. 2—Tolerance zones for screw and nut, as given in the British War Emergency Standard B.S. 1095—1943 are shown in relationship to the basic profile of the SI thread, indicated by the heavy line

A German standard sheet (Appendix 3 to DIN 13 and 14) specifies the limits of the screw and nut, for metric-threads belonging to ISA Series *A* (see Table 2), in nominal sizes from 2 to 149 mm., inclusive. Two grades of accuracy are given, which are designated as Coarse and Medium. The medium-grade tolerances are given for the entire range of sizes (2 to 149 mm.) and the coarse-grade tolerances for the range 5 to 149 mm., inclusive. The pitch-diameter tolerances on screw and nut are equal and there is no pitch-diameter allowance. Therefore, the maximum screw and the minimum nut have metal-to-metal contact.

The set-up of the German system of thread limits is explained in a German standard (DIN 2244). At the time this was published in 1933 a Fine grade tolerance was considered, but it does not appear in the 1940 German catalog.

Tolerances and limits established in the U.S.S.R. for metric-threads in nominal sizes from 6 to 68 mm. (see OST 32) are given in OST 1251 and 1252, for two grades of

Table 4—Comparison of Pitch Diameter Tolerances Applicable to Metric-Threads and American Standard Threads

Metric-Thread (ISA Series A)	Grade of Tolerance	Pitch Diameter Tolerance on Screw and Nut (in inches)*	
		D = 24 mm. p = 3 mm.	D = 10 mm p = 1.5 mm.
German Standard (DIN 13 and 14, App. 3)	Medium	0.0070	0.0049
	Coarse	0.0116	0.0082
British Emergency Standard (BS1095-1943)	Close	0.0046	0.0032
	Medium	0.0068	0.0048
	Free	0.0102	0.0071
	Grade of Tolerance	1"-8NC	3/8"-16NC
American Standard Coar Thread (B1. 1-1935)	Class 3	0.0054	0.0032
	Class 2	0.0076	0.0045
	Class 1**	0.0111	0.0063

*The inch values have been converted, with close approximation, from the metric values.

**American Standard Class 1 threads have a pitch diameter allowance, but the German Coarse and British Free grade threads have none.

accuracy corresponding to the German medium and coarse grades. No pitch-diameter allowance is specified. Similar data for metric threads in sizes from 72 to 600 mm. with constant pitch of 6 mm. (see OST 193) are found in OST 1253. Finally, corresponding data for threads in sizes from 1 to 5 mm. (see OST 94) are given in OST 1254, for the two grades of accuracy.

The British Standard 1905-1943 gives tables for the limiting dimensions of threads in ISA Series *A*, in sizes from 6 to 60 mm., inclusive. It gives corresponding data for threads of special diameter, pitches and lengths of engagement, in sizes ranging from above 3 mm. to 500 mm., inclusive, and for pitches from 0.5 to 6 mm., inclusive. The British have adopted three grades of thread tolerances, designated as Close, Medium and Free. In each grade, the pitch-diameter tolerances on the screw and nut are equal. They are applied from the basic pitch diameter, plus for the nut and minus for the screw. In other words, there is no pitch-diameter allowance. In Fig. 2, the basic profile of the SI thread is shown by a heavy line and the British tolerance zones for the screw and nut are indicated for a Free fit. This shows great similarity with that of a Class 2 or 3 fit in American Standard threads. However, new British threading tools are assumed to have round crests.

FOREIGN STANDARDS FOR METRIC THREADS

(Listed according to thread sizes covered)

WITH few exceptions foreign standards for metric threads are published on single sheets, instead of in pamphlet form. Therefore, if a manufacturer is concerned with a limited range of metric threads, he will need only the sheet or sheets covering that range. For convenience, the metric-thread standards of 14 countries are listed below in respect to size ranges and corresponding standard numbers. In some cases, a given series of threads is published on two or more sheets, each of which covers a part of the total range. So to avoid errors when ordering foreign standards on metric threads from the American Standards Association, 70 East 45th St., New York, N. Y., it is suggested that the size or sizes of threads wanted be specified.

It should be noted that the designations of series, as given on these national standards sheets, do not in general agree with the ISA series designations *A to E*. Thus, a sheet known as Series II is not equivalent to ISA series *B*, thus showing how detail variations cause confusion.

AUSTRIA

1 to 10 mm. (M 1501); 6 to 80 mm. (M 1502).

CZECHOSLOVAKIA

Series *A*, 1 to 149 mm., Fine Threads: Series *B*, 1 to 300 mm.; Series *C*, 8 to 300 mm.; Series *D*, 24 to 300 mm.; Series *E*, 35 to 300 mm. (All in pamphlet CSN 1001-1938).

DENMARK

1 to 10 mm. (DS 5); 6 to 80 mm. (DS 6). Fine Threads: Series I, 1 to 300 mm. (DS 128, 4 sheets); Series II, 8 to 300 mm. (DS 129, 4 sheets); Series III, 24 to 200 mm. (DS 130, 2 sheets); Series IV, 35 to 150 mm. (DS 131, 2 sheets).

FINLAND

1 to 10 mm. (BI.2); 6 to 80 mm. (BI.3); 64 to 149 mm. (BI.4). Fine Threads: 1 to 80 mm. for bolts, screws and nuts (BI.11); 14 to 52 mm. pitch 1.5 mm. (BI.12); 34 to 100 mm. pitch 2 mm. (BI.13); 55 to 200 mm. pitch 3 mm. (BI.14); 82 to 500 mm. pitch 4 mm. (BI.15).

FRANCE

1 to 2.5 mm. (CNM 132); 3 to 125 mm. and upward by 5 mm. (CNM 3). Fine Threads: 6 to 85 mm. and upward by 5 mm.; pitches from 0.75 to 6 mm. (CNM 31).

GERMANY

1 to 10 mm. (DIN 13); 6 to 149 mm. (DIN 14). Fine Threads: Series 1, 154 to 499 mm. pitch 6 mm. (DIN 241); Series 2, 24 to 189 mm. (DIN 242); Series 3, 1 to 300 mm. (DIN 243, 3 sheets); Series 4, 12 to 250 mm., pitch 1.5 mm. (DIN 516); Series 5, 9 to 82 mm., pitch 1 mm. (DIN 517); Series 6, 6 to 80 mm. pitch 0.75 mm. (DIN 518); Series 7, 4.5 to 80 mm. pitch 0.5 mm. (DIN 519); Series 8, 3 to 50 mm. pitch 0.35 mm. (DIN 520); Series 9, 2.3 to 22 mm. pitch 0.25 mm. (DIN 521).

GREAT BRITAIN

6 to 125 mm. and upward in steps of 5 mm. and special threads in sizes from above 3 to 500 mm. and pitches from 0.5 to 6 mm. (BS 1095-1943).

ITALY

1 to 80 mm. (UNI 159). Fine Threads: Series B, 1 to 80 mm. (UNI 160); 1 to 600 mm. pitch 0.25 to 6 mm. (UNI 16).

NETHERLANDS

1 to 9 mm. (N 81); 10 to 149 mm. (N 82). Fine Threads: 1 to 100 mm. (N 179); 100 to 300 mm. (N 1144).

NORWAY

1 to 30 mm. (NS 72); 33 to 149 mm. (NS 73). Fine Threads: Series B, 1 to 189 mm. (NS 268); Series C, 24 to 200 mm. (NS 269); Series D, 36 to 200 mm. (NS 270).

POLAND

1 to 33 mm. (PN-G 205); 33 to 149 mm. (PN-G 206). Fine Threads: Series A, 1 to 33 mm. (PN-G 216); 33 to 149 mm. (PN-G 217); Series B, 24 to 149 mm. (PN-G 227). Note: The Polish designations *A* and *B* do not refer to the ISA Series with the corresponding designations.

SWEDEN

1 to 150 mm. (SMS-2B). Fine threads for bolts, screws, and nuts, 1 to 80 mm. (SMS-181A). Threads for general engineering purposes: 4 to 50 mm. pitch 0.5 mm. (SMS-401); 6 to 75 mm. pitch 0.75 mm. (SMS-402); 8 to 100 mm. pitch 1 mm. (SMS-403); 12 to 150 mm. pitch 1.5 mm. (SMS-182A); 24 to 200 mm. pitch 2 mm. (SMS-183A); 36 to 300 mm. pitch 3 mm. (SMS-184A); 56 to 400 mm. pitch 4 mm. (SMS-185A); 155 to 600 mm. pitch 6 mm. (SMS-404).

SWITZERLAND

Review of series *A* to *E*, diameters and pitches, VSM 12001. The series on sheet VSM 12001 are identical with those in ISA Bulletin 26. (In ISA Series *A*, the Swiss follow the 5-0-5 progression, for diameters above 80 mm.) 1 to 10 mm. (VSM 12002); 6 to 80 mm. (VSM 12003); 85 to 150 mm. (VSM 12004). Fine Threads: Series *B*, 1 to 150 mm. (VSM 12005, 3 sheets); Series *C*, 8 to 150 mm. (VSM 12006, 2 sheets); Series *D*, 24 to 150 mm. (VSM 12007, 2 sheets); Series *E*, no standard published.

U.S.S.R.

6 to 68 mm. (OST 32); 72 to 600 mm. pitch 6 mm. (OST 193); 1 to 5 mm. (OST 94). Series 1, 1 to 400 mm. (OST 271); Series 2, 6 to 300 mm. (OST 272); Series 3, 8 to 200 mm. (OST 4120); Series 4, 9 to 150 mm. (OST 4121); Series 5, 42 to 125 mm. (OST 4122).

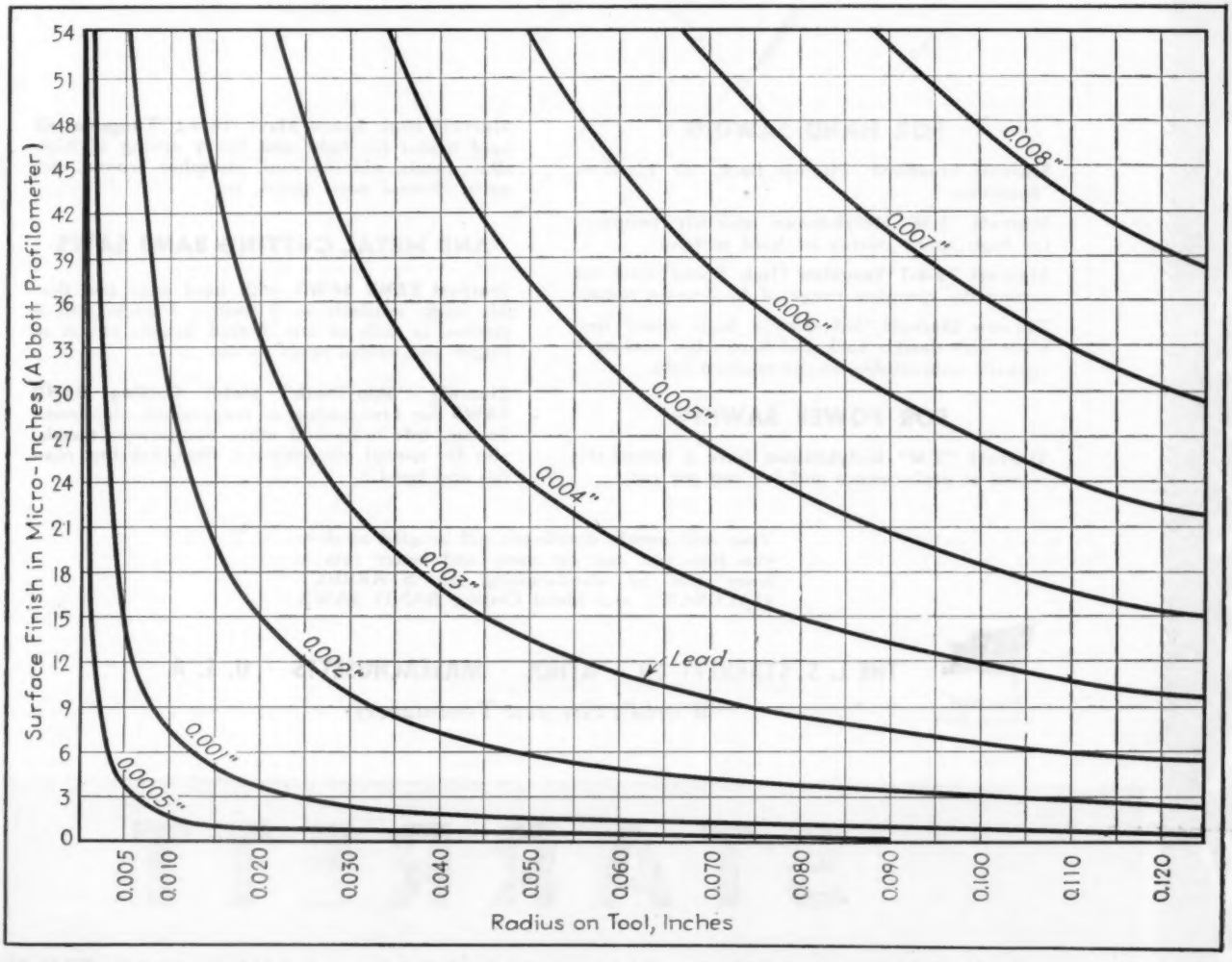
Surface-Finish Chart For Precision Turning and Boring

BY BRUNO HOLMSTROM, TOOL SUPERVISOR, THE HEALD MACHINE COMPANY

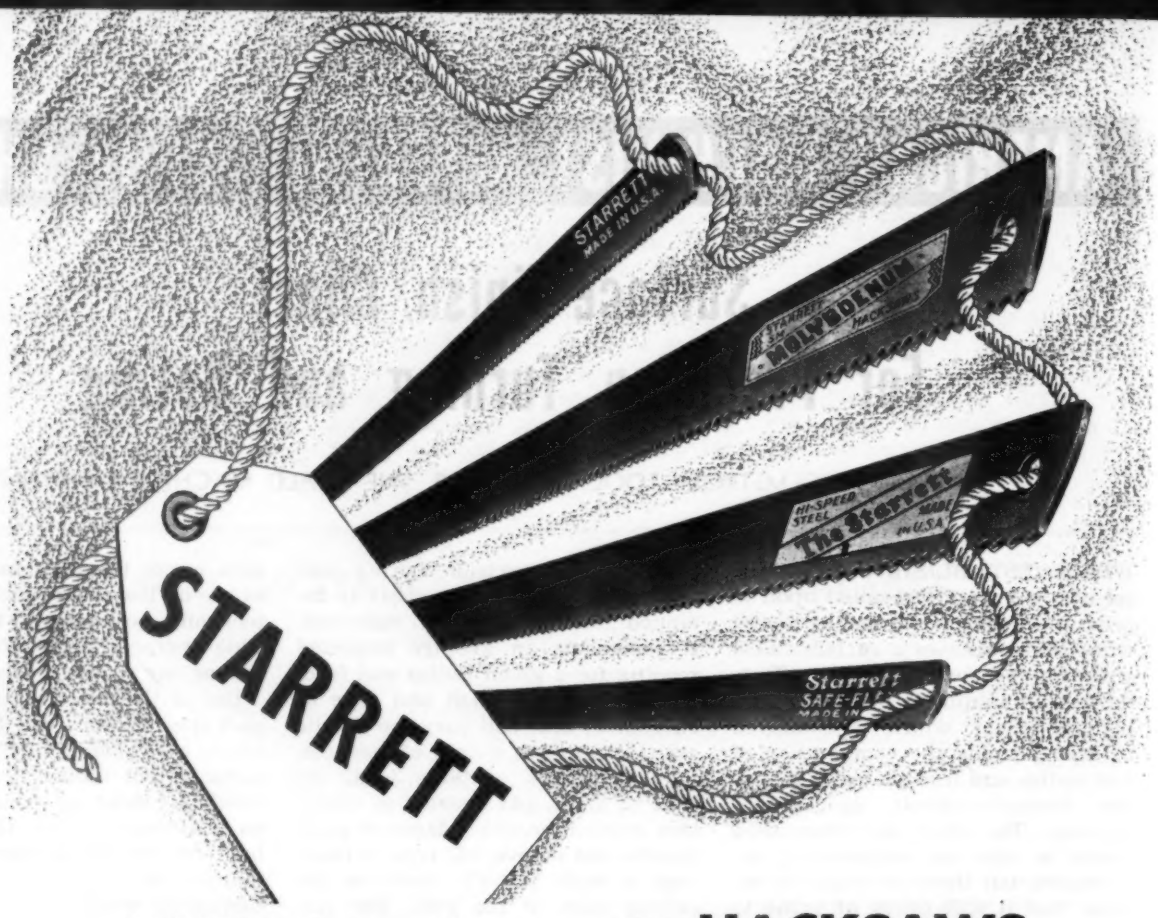
WHEN ESTABLISHING machine set-ups, we are often called upon to produce precision turned or bored work that possesses a surface finish within a specified limit. Our efforts have been simplified by the accompanying chart, which is employed to predetermine the combination of tool radius and lead that will realize the desired Abbott profilometer reading. The chart has been used solely in our tool engineering department, but there is reason to believe that it will prove of value to operators of precision boring and turning machines. The chart is intended for non-ferrous materials. It represents an average expected reading for a given radius and lead.

Factors in condition and type of equipment that will vary the results are: (1) Size and weight of machine, (2) smoothness of table feed, (3) type of drive, (4) amount of vibration in machine, (5) balance of quill, spindle and sheave, (6) type of bearings in head, and (7) finish on the cutting edge of the tool. The last item is not the least important, because in low micro-inch work, the tool must be lapped to the best possible degree of finish, frequently as low as one to two micro-inches.

Use of the chart is simple. If the part specifications call for a surface finish of 12 micro-inches, select a suitable tool radius. This might be 0.060 in. Read up from this value on the chart to the 12 micro-inch line and find the nearest lead, which in this case is 0.003 in. per revolution of the work.



STARRETT HACKSAWS



MAKES A *Complete Line* OF HACKSAWS

FOR HAND SAWING

Starrett Standard Flexible Back, All Hard or "Semi-Flex."

Starrett "S-M" Molybdenum specially tempered for high speed cutting of hard metals.

Starrett 18-4-1 Tungsten High Speed Steel for cutting the complete range of hard-to-cut metals.

The new Starrett "Safe-Flex" a high speed steel blade with flexible back and hard edge, making it virtually unbreakable on the toughest jobs.

FOR POWER SAWING

Starrett "S-M" Molybdenum have a remarkable record of performance and low cost per cut.

Starrett High Speed Steel 18-4-1 Tungsten all hard blades for light and heavy sawing of high alloy metals, stainless steel, phosphor bronze, tool steels, chrome steel, monel, etc.

AND METAL CUTTING BAND SAWS

Starrett BAND SAWS with hard edge and flexible back, available in 9 widths, 3 gages and 8 pitches, in coils of any desired length, or cut to length and welded ready to use.

Starrett "Skip-Tooth" Metal Cutting BAND SAWS for fast cutting of magnesium, aluminum, bronze, soft brass and other non-ferrous metals; also for special compositions, fibre, bakelite, plastics and wood.

Your mill supply distributor will be glad to show you how you can get more and better cuts at lower cost by standardizing on STARRETT HACKSAWS and Metal Cutting BAND SAWS.

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THE L. S. STARRETT CO · ATHOL · MASSACHUSETTS · U. S. A.

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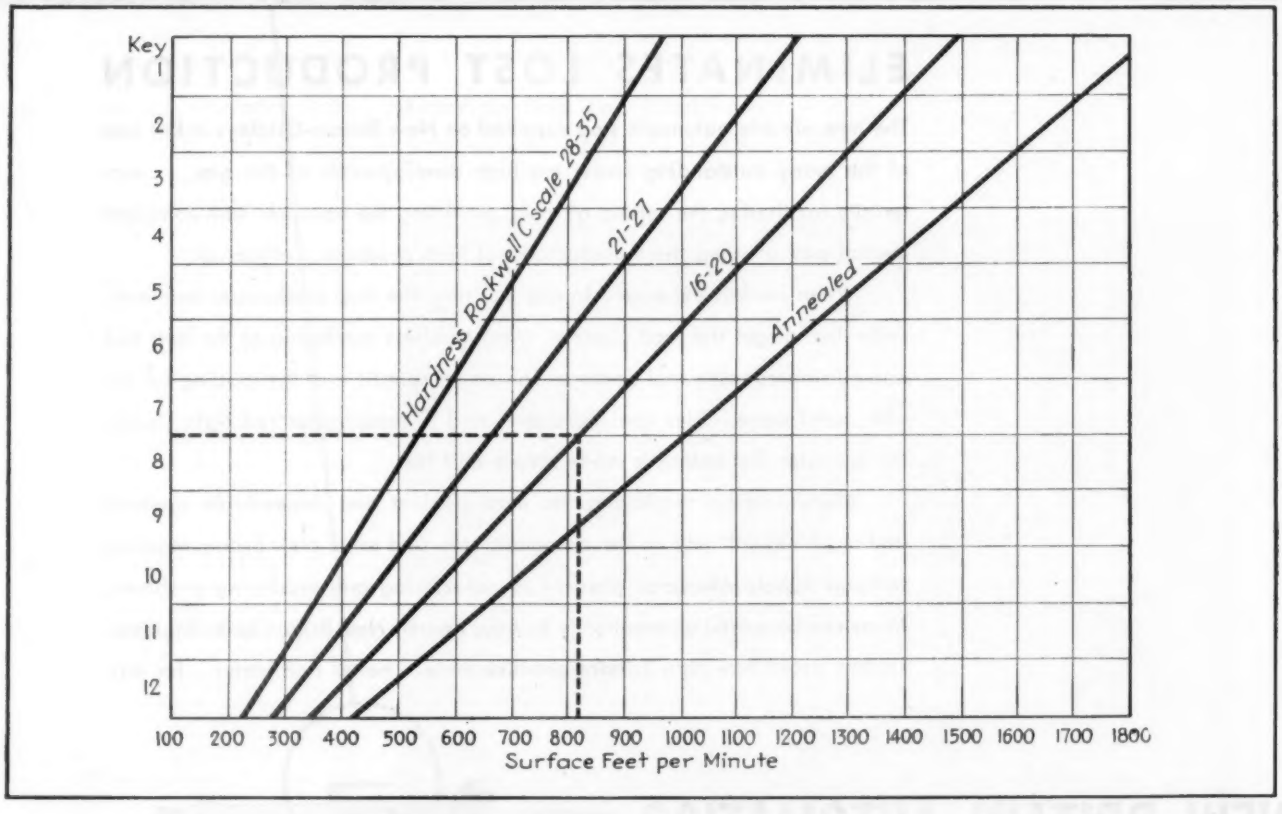
Surface-Speed Chart for Precision Boring

BY BRUNO HOLMSTROM, TOOL SUPERVISOR, HEALD MACHINE COMPANY

WHEN STARTING a new job of precision boring or precision turning an SAE steel, the accompanying chart will prove helpful in connection with selecting the surface speed This chart was prepared on the basis of the speed that will give best finish on the workpiece, not necessarily the best tool life. Of course, the surface speed at which the operation will finally run will be affected by tool shape, thickness of chip, work composition and other factors.

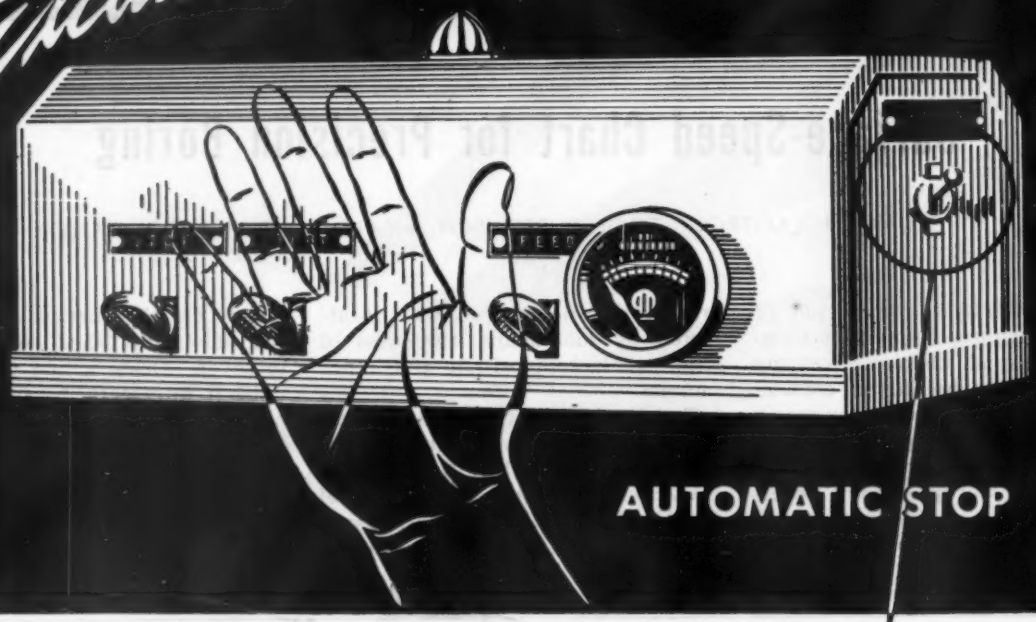
To use the chart, proceed as follows: Find the key number of the steel in the table "Key Numbers for SAE Steels." Suppose that the steel is SAE 2315 and that its hardness is 20 Rockwell C. The key number is seven. On the surface speed chart, read down the "Key" column at left to seven. Draw a line to the right until it intersects the proper hardness curve, in this case Rockwell C 16-20. Then from this intersection drop a line to the scale for surface feet, where it will be seen that the best finishing speed is approximately 820 ft. per min.



KEY NUMBERS FOR SAE STEELS

1010	4	1095	12	T1335	8	2335	11	3130	10	3312	11	4115	8	4620	11	6115	9
1015	4	1112	1	T1340	8	2340	11	3140	11	3325	11	4130	10	4640	12	6120	10
1020	4	1115	2	T1345	8	2345	11	X3140	11	3330	11	X4130	10	4650	12	6125	11
1030	6	1120	2	T1350	9	2350	11	3145	11	3335	12	4135	12	4815	11	6130	11
1035	7	X1314	3	2105	7	2512	10	3150	11	3340	12	4140	12	4820	11	6135	11
1040	8	X1315	3	2115	7	2515	11	3230	11	3415	10	4150	12	5120	10	6140	11
1045	9	X1330	5	2315	7	3115	8	3240	12	3430	12	4340	12	5130	10	6145	12
1050	10	X1335	7	2320	10	3120	9	3245	12	3435	12	4345	12	5140	11	6150	12
1060	11	T1330	7	2330	11	3125	10	3250	12	3450	12	4615	11	5150	11	51210	9

Exclusive WITH NEW BRITAINS



ELIMINATES LOST PRODUCTION

The new electric automatic stop supplied on New Britain-Gridleys is but one of the many outstanding screw machine developments of the era . . . materially facilitating the setting of tools, providing the operator with complete control and assuring the manufacturer of high production efficiency.

When stock is exhausted in any position, the stop mechanism automatically disengages the feed clutch to avert needless machining of the butt end and eliminates costly tool damage. The empty spindle is at the loading station with collet open, slides are withdrawn and a conspicuous red light signals the operator. Reloading is made simple and fast.

Manufacturers employing the most efficient and dependable methods and machines will rely on the automatic stop and other New Britain Machine features to help overcome postwar manufacturing and marketing problems. Many can be solved automatically by your nearby New Britain Sales Engineer. Let him prove how New Britains produce more...better and faster...for less.

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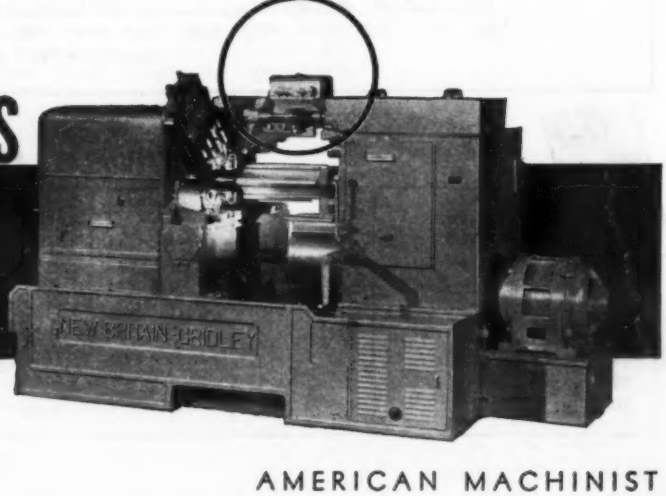


M-01006-A

Gaging Business

Reconversion Uncertainties

Reconversion may not proceed as smoothly as Washington has predicted, unless several major uncertainties in the machine tool situation are ironed out very swiftly. This seemed to be the major attitude of tool builders and the auto industry this week as the status of $70,000,000 in Russian tool orders remained in doubt, and the AA-3 priority assigned for reconversion tools continued to be inadequate in certain cases.

President Truman has indicated that Russian shipments would be continued "to the extent agreed upon until the protocol lapsed." However, the Russians were assured prior to VE-Day that those lend-lease tools not delivered to them by June 30, 1945, the end of the current protocol year would be delivered by September 30, 1945. Thus, the President's statement leaves the status of tools scheduled for delivery during the third quarter up in the air, and that probably involves some $40,000,000 in Russian tool orders.

What makes the status of the Russian business so much in doubt is the question over whether or not the Russians will declare war with Japan. If they do, there would be no reason for holding up lend-lease tool shipments. If they do not, but international matters give cause for our continuation of such shipments, then again, such business would not be disturbed. These considerations hold up any official decision on this matter, but they do confuse the reconversion tool situation.

Military Pressure Easing

April witnessed the largest cancellations the industry has had in many months. Cancellation of $26,562,000, mostly in military tool orders, left the industry with a backlog of $287,920,000, as compared with $309,650,000 at the end of March. New orders of $43,965,000 were well below March's $52,536,000 total, although shipments of $40,331,000 were slightly above March's $39,374,000.

But even after the large cancellations of military orders in April, it is obvious that the industry has seven months' business on hand, with AA-1 military and Russian orders still blocking reconversion tools. From Detroit come reports that several auto companies have still been unable to secure assured delivery as needed of hundreds of machine tools.

New Military Orders

But one factor that is frequently overlooked is the continued placing of new military orders for tools required in plants in war production, as replacements, and for various new and special war uses. Such tools are rated AA-1 and take preference over reconversion orders, which are rated AA-3. However, dwindling orders on some types of machines enable tool builders to fill even low-rated orders. But critical spots remain in special items. Presses continue to be in a tight position, and delivery promises do not now meet the auto industry's requirements.

The decline in war employment, coupled with demobilization of thousands of veterans will bring intense pressure upon Washington to push deliveries of reconversion tools. There has been some talk of assigning AA-1 priorities to such orders.

Materials Not Too Bright

Official predictions of plenty of steel and other materials to permit the production of large amounts of civilian goods in coming months may go by the boards. The reasons are many, but the most important one is that military cancellations have not loomed as large as was expected. Moreover, they have not occurred in the types of steel required for civilian production, notably sheets. At the same time, the continued critical position of tin, rubber, lumber and textiles will hamper reconversion production of items requiring the use of these materials. There are still reports that auto resumption may be delayed due to lack of textiles, even if machine tools and steel are made available.

Labor may also prove a reconversion stumbling block, since unions have already stated their intention of seeking wage increases to offset the elimination of overtime in any logical return to the 40-hour week. The OPA's continued tight control on prices may tie up some reconversion if wages are lifted and manufacturers must wait for price relief to offset higher wage costs. The treatment recently accorded to the steel industry on prices leaves little hope for relief which industry considers adequate. Thus far, the OPA and industry's attitude on this seem far apart.

Mobile Machine Shop for Chinese Armies—The U. S. Army has contributed to the Chinese armies a number of GMC 2½-ton ordnance machine shop mobile trucks. A Chinese Ordnance officer is here being shown the equipment inside the mobile shop truck, including a bench shaper, lathe, drill press, bench grinder, portable electric drills and a 5 KW generator set. The lathe has a complete set of accessories in addition to a milling attachment, and the shop also carries a complete stock of machinist's hand tools and gauges.

Machine Tool Builders Discuss Postwar Problems

Speed with which critical machines are produced will determine extent of reconversion layoffs. Vital need for engineers, designers and draftsmen stressed. Main task of the industry to design machines to cut costs.

NEW YORK—The important part that machine tools will play in reconversion and the industry's many problems were the principal topics discussed at a regional meeting of the National Machine Tool Builders' Association at the Waldorf-Astoria on May 15.

The extent to which layoffs and unemployment will be reduced in the reconversion period will depend upon the speed with which critical postwar machine tools are turned out, according to Joseph L. Trecker, president of the association and executive vice president, Kearney & Trecker Corp.

Mr. Trecker stressed the vital importance of increasing the forces of engineers, designers and draftsmen in machine tool building companies and made a plea for the release as soon as possible of such men from the armed services. He said that lots of standard machine tools should be available from surpluses for reconversion purposes, but red tape thus far has interefered with getting such tools into use.

Postwar Tool Market

The postwar market for machine tools, prophesized Mr. Trecker, will be for special machines for domestic use, and for standard and special tools for export. If business should reach anywhere near as high a level as everyone hopes for, the market for special machines will be very big. With too much capacity on hand, the tool industry will find it difficult to carry its plant and equipment after the war. Largely because of renegotiation, the industry will be pretty badly squeezed on the financial side. Mr. Trecker said, "We must turn to engineering to compensate for what we lack in cash. Our chance for survival depends upon the speed and skill with which we redesign our machine tools."

The armed services should retain an ample share of their currently-owned machine tools as insurance against being caught again as they were in 1940-1941, asserted W. P. Kirk, first vice president of the association and vice president, Pratt & Whitney Division, Niles-Bement-Pond Co. One trouble today is that no one knows what the government actually owns. After the services have decided what they want to keep, the remaining machine tools should be put into production in industry as fast as possible.

Surplus Priorities Useless

Mr. Kirk said that there is no place in surplus disposal for the priority regulations set up in the present law. The plan for offering surplus tools first to one preferred class of buyers and then to another and so on, is economically unsound and will result in costly delays. The truth is, he pointed out, that there will be plenty of surplus tools for all classes of buyers, hence priorities are unnecessary.

The market for newly-designed machine tools will be large, but the margin of improvement over previous models must be appreciable to justify the investment and to attain the extra margin of economy to offset increases in other cost factors, declared E. Payson Blanchard, sales manager of the Bullard Co., in discussing sales and advertising plans. He made a plea for each tool builder to define his position by measuring his own part of the surplus and knowing what of his own tools or competitive tools are threatening his current market.

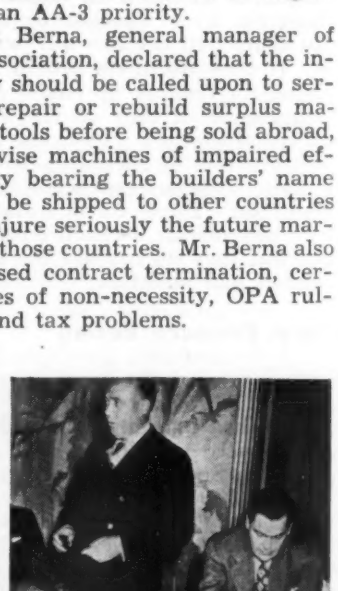
Discretion and good judgment must be shown by builders, said Mr. Blanchard, in selecting where and when to push the sales of new equipment as against utilizing some of the surplus.

Mr. Blanchard said that export markets promise good machine tool business. England, Switzerland, Sweden and other countries will compete for new markets, such as South America, China and India.

Russian Order Ratings

James Y. Scott, chairman of the association's government relations committee and president of the Van Norman Co., reported on the work of his committee. James A. Wright, former assistant director, Tools Division of WPB, and assistant sales manager, Machine Tool Division, Van Norman Co., told the group about the latest Washington developments. He predicted that future cash orders from Russia would have no higher than an AA-3 priority.

Tell Berna, general manager of the association, declared that the industry should be called upon to service, repair or rebuild surplus machine tools before being sold abroad, otherwise machines of impaired efficiency bearing the builders' name might be shipped to other countries and injure seriously the future market in those countries. Mr. Berna also discussed contract termination, certificates of non-necessity, OPA rulings and tax problems.



Among those present at the NMTBA's May 15th meeting in New York were E. Payson Blanchard (at left), sales manager, Bullard Company; (center photo) Tell Berna, general manager, National Machine Tool Builders' Association; Joseph L. Trecker, exec. vice-president, Kearney & Trecker Corp., and president of NMTBA; Herbert H. Pease, president, New Britain-Gridley Machine Division, New Britain Machine Co.; James A. Wright, asst. sales manager, Van Norman Co.; (photo at right) James Y. Scott, president, Van Norman Company, speaking, and William P. Kirk, vice-president, Pratt & Whitney Company.

Detroit Letter

Price Battle Looms

Next to the fumbling of the Fisher Brothers' deal for Hudson, the biggest puzzler here is the announcement of General Motors that it plans a low-priced Chevrolet.

So far, C. E. Wilson, president of GM, has remained quiet and unperturbed. He has passed it off as merely a routine announcement of something in the idea stage. Against this is the fact that General Motors has never before announced anything that is merely an idea in the future. Secondly, Wilson himself has rarely if ever before made an announcement affecting one of the divisions. The division itself usually made the announcement of a new model.

GM Answers Ford

What observers in the industry see in the announcement is a resumption of the battle for supremacy in the automotive field. Ford sometime ago stated it would produce a low priced car, in response to the demands of its dealers. The Washington dealer's announcement of a $500 car was a trial balloon. The company received thousands of letters from all over the country about this $500 car and became convinced there was a demand for it. Now it has such a model ready to put into production, with the five-cylinder engine as a feature of it.

The GM announcement may be just to offset the interest shown in Ford's. On the other hand, it may be the gesture tossing down the glove to its rival. Chevrolet has held the supremacy in the low-price field for many years. It intends to fight to retain it, whether with the lower priced job that Wilson revealed so vaguely or with its regular line. But a fight it will be.

Chrysler has not yet entered the ring. It has said nothing about a lower-priced Plymouth to meet the competitive market. But it's a safe bet they're doing something about it.

Fisher-Hudson Deal

The Fisher deal for Hudson was finally brought into the open after months of rumors and whisperings. But it proved anti-climactic. The deal, despite some denials later, was definitely on. But poor strategy on the part of those who favored it caused it to fall through.

A faction in the Hudson ranks has tried for some time to unseat A. E. Barit as president of the company. A shrewd and capable strategist, Barit has managed to fend off all attempts to get his $100,000 job.

This time, the push was really on. Barit's opponents thought they had the deal lined up and with the prestige of the Fisher name behind it, they could put it over. But Barit again outsmarted them and what will become of the proposition remains to be seen. There is some feeling that now that it has been brought out into the open the Fisher brothers will pull out.

Auto Resumption Doubts

Although assured of making automobiles sometime this year, the industry is still waiting its blueprint from Washington. The companies have been shown tentative quota figures which will be greatly revised before they are actually put into effect and have until now merely "hunting licenses" for materials and components.

Vital machine tools are still not in the lines and there is some doubt that many will be produced before mid-July. Chrysler has 902 machine tools on its list of "musts" with no great assurances it can get them all under the AA-3 rating.

Assurances on Presses

Government experts, however, seem to have no worry about the ability of the industry to get tooled up in time to go ahead this year. Main bottleneck has been heavy presses and a WPB official expressed the view that these will be ready.

Tires are the only component that the government has agreed to furnish help. Batteries, lead, tin and copper are some of the items which the companies will have to scramble around for. Their well-known ingenuity will be taxed to the limit on some of the short components, especially textiles.

Truck Chances Good

The increased civilian truck program may be a great rival for passenger cars in reconversion period. Some of the components which could go into automobiles will be diverted to the light and medium trucks. WPB has frankly told manufacturers they will give all preferences to trucks over cars and the AA-2 ratings for trucks prove it.

Even when WPB gives the industry the signal to start on cars, there will be two vital points which will cause much dissension. One is quotas, the other prices.

The tentative quota figures have displeased the smaller companies, especially Willys and Crossley. They have been weighted somewhat in favor of the smaller producers and against the Big Three. But there is still dissatisfaction. The same will be true on prices, when that point is reached.

Canada Reconversion Starting; U. S. Firms Seek Montreal Plants

MONTREAL—The post-VE-Day period for Canada, known as Stage 2, includes further gradual changes from war to peacetime production. Further cuts will be made in ammunition, small arms, armored vehicles, trainer planes, and various instrument items, but shipbuilding and truck production will hold up. Any reductions in military truck requirements will probably be translated into civilian trucks.

Meanwhile, some controls are to be relaxed and the Wartime Prices and Trade Board is expected to cancel certain restrictions on the sale of consumer goods, principally household items such as washing machines, radios, vacuum cleaners, etc. Civilian requirements in these everyday lines are heavy and relaxation of controls in this field will permit a more rapid switchover of war industry to peacetime production.

U. S. Outlet Sought

Some 50 U. S. industrial firms plan to establish branches here in the near future, according to inquiries received by the Montreal Economic and Tourist Development Bureau. These fall into the following categories: Metal products, 14; plastics, 2; wood products, 1; chemical firms, 4; textile products, 10; others, 18. Total investment by these firms is estimated at $50,000,000.

Increased interest on the part of U. S. industries to establish producing units in Montreal is attributed by Valmore Gratton, head of the Bureau, to: (a) desire to find outlets for surplus corporate funds; (b) concern over postwar labor conditions and the hope of avoiding tieups by decentralization of activities; (c) the fact that some war items have been produced in Canada at lower cost; (d) speculative interest in the dollar differential; and (e) the belief that British preferential tariffs will continue to offer more favorable access to Empire markets for products made in Canada. Mr. Gratton also mentioned the possibility that U. S. firms might be interested in converting some of Canada's existing war plants into peacetime production units.

Prices, Slow Cancellations Upset Civilian Steel Needs

PITTSBURGH—Steel observers hold that price increases awarded on 14 basic products to offset higher operating costs are inadequate. Moreover, there is concern over the strings attached to the award: the government's contention that other profitable steel products should be reduced in price and its order that recommendations be prepared by the industry within 60 days on items available for price cuts.

The beginning of reconversion in the face of continuing controls make prices particularly important to the industry now, since cost reductions under controls are apt to be smaller than under competitive conditions. The passing of VE-Day will make cost reductions feasible without cutting labor rates. Extended overtime will be eliminated, which may bring further cost reduction by increasing efficiency and reducing absenteeism.

Third Quarter Critical

Steel leaders feel that the test of reconversion will come in the third quarter. E. T. Weir, Chairman, National Steel Corporation, has predicted that "there will be available for civilian products within a few months more steel than many people think," and said he expected a downturn in steel operations around September 1. He expects that important consumers will make purchases carefully, and not frantically, as many people seem to expect.

Despite relaxed WPB controls to make excess steel available for civilian use, military cutbacks are coming through slowly. It is believed the Armed Forces are stocking up, but that cuts will appear before long. Unless this develops, there will be no capacity on some finishing mills, notably sheets, to take care of authorized civilian production. Some automobiles, mechanical refrigerators and washing machines to be made in coming months may have to be produced from surplus sheet, scattered over the country.

Sheet Situation Bad

The sheet situation may be slightly eased by probable heavy cuts in ammunition containers and landing mats. But there may be such competition for sheets that WPB may have to decide prior claims on the basis of need. For example, should railroad cars come ahead of autos?

Steel bar promises have to be almost as protracted as sheets. There have been some shell steel cancellations, but not enough. Cold-drawn bars are so tight, directives for military orders have to be used.

There is plenty of open space on plate mills, and makers need new orders. This puts railroads in good position to obtain steel, but they may have trouble on components. Some heavy machinery deliveries have been held up due to lack of automatic lubricating equipment. Cancellations have not materially eased the position of wire mills, but tubular goods are easier. If possible the tin plate quota for the third quarter will be higher.

COAST HAS "CONVERSION" TASK, NOT RECONVERSION—McNUTT

LOS ANGELES—In announcing the change in the classification of the Los Angeles area from a Group I to a Group II area, Paul V. McNutt, chairman, War Manpower Commission, said, "Out here it is not reconversion, but conversion you are talking about, conversion of your wartime expansion to the manufacture of peacetime goods." Expressing confidence in the West's ingenuity "to do it when the time is ripe," McNutt indicated that the War Manpower Commission plans to spread remaining war production and conversion as evenly over the nation as possible.

Although reclassification of this area involves no changes in ceilings on male employees, it will permit assignment of new war contracts here where facilities and labor may be available.

Paul Christensen Selected to Head A. G. M. A. at Executive Meeting

HOT SPRINGS, VA.—Because of travel restrictions, the regular annual meeting of the American Gear Manufacturers Association was cancelled. A special meeting of the Association's executive committee and other committee chairmen was called instead on May 21 and 22.

Officers elected to serve for the coming year were: president, Paul W. Christensen, Cincinnati Gear Works; vice-president, Thomas J. Bannan, Western Gear Works; treasurer, Raymond B. Tripp, Ohio Forge and Machine Corp. Newbold C. Goin was reelected executive secretary. New members of the executive committee are: Ernest N. Twogood, General Electric Co.; Howard Dingle, Cleveland Worm & Gear Co.; Joseph R. Mahan, National Supply Co.; and Elmer H. Johnson, Gear Specialties.

The only technical paper presented at the special meeting was a progress report on carbide hobs for cutting marine propulsion gears. The authors, Lt. Alfred J. Kroog, U.S. Navy, and Richard W. Righter, engineer, Navy Department, described the experiments conducted since their report before the A. G. M. A. semi-annual meeting at Chicago last fall.

The work done recently on carbide hobs used a 72-in. Gould & Eberhardt machine which had been modified to give the higher speeds needed for these cutting tools. Speeds up to 351 surface ft. per min. were used with hobs having Kennametal R-4H inserted teeth. Feeds of 0.030 to 0.040 in. per revolution proved to be most satisfactory. Kerosene used as a cutting lubricant gave better results than high viscosity cutting oils with a sulphur base. Further tests are planned by the Navy Department on the hobbing of marine gears.

NEW AMERICAN GEAR MANUFACTURERS ASSOCIATION OFFICERS

President

P. W. Christensen

Vice-President

T. J. Bannan

Treasurer

R. B. Tripp

Washington Bulletin

Merchant Ship Problem

History will soon begin to repeat the First War record on merchant ships. Congress will have to decide whether to allow the repetition, or to take planned action. Army and Navy know that the United States could have been effective as the Allied arsenal a year or two sooner than it was if enough ships had been available. They fear that Congress and the public, having observed a near-miracle in the construction of 47 million deadweight tons in 2½ years, will be inclined to take the easy way and depend on another such performance in any future emergency.

It is a fact, undemonstrable in exact figures, that time, added to the war while ships were building, cost a great deal more than a big peacetime merchant marine would have cost. It must be noted also that President Roosevelt's administration saw the war coming and got a five year jump on it with the direct ship subsidy act of 1936. Except for that, the country would have been in real trouble. The big question is whether to keep our huge merchant marine, and haul our own international trade, or dispose of it so our shipbuilding industry will have a job. If we sell or give it away, it may be used against us, in scrap steel or in service, in another war. And if we keep it and use it, we will have to subsidize it.

Auto Reconversion Plans

As viewed here in Washington, the War Production Board's program for reconversion to automobile production is satisfactory. Complaints by auto worker union leaders that tools and steel and men are available to start immediately, are discounted by representatives of the industry in the Capital. They believe that WPB is in full sympathy with the public demand and need for cars and trucks.

Navy Cut One-Third

Secretary James Forrestal and other high Navy officials testifying before Congress on an appropriation bill said the postwar Navy would be about one third its present strength. Of the present 12,000 ships of all types, about half will be obsolescent, and the rest will remain in service, with about 50,000 officers and 500,000 men. Of 39,000 Navy airplanes now in use, about 70 percent are combat types. The future of the Navy is unpredictable, depending upon the competition between aircraft carriers and long-range planes. The Navy is going into jet-propelled fighters, whose range is short thus far, which means they would be based on even faster and better carriers. Twin-engined attack planes are being tried on carriers, and this may lead to eventual deck-basing of medium and even heavy bombers.

Postwar Prospects Uncertain—One major unanswered question in Washington is what will happen to the nation's huge merchant fleet. Will we keep it postwar or give it away? Meanwhile, our ships are concentrating on the Pacific war job, with the ships shown here taking on fighting planes and other war materials at a West Coast port.

Gets Reparations Post

George H. Johnson

President Truman has appointed Mr. Johnson an advisor on machine tools and metals to the American representative on the Allied Reparations Commission to meet soon in Moscow on German reparations. Mr. Johnson is president, Gisholt Machine Co., and former director, Tools Division, War Production Board.

Curbing War Costs

The time has come for controversy to break out on accession to Army and Navy for nearly everything they want. The Pacific pipelines from American factories, and the roadsteds from the European theater, contains mountains of war goods and weapons that will never be used. Before long Congress will call for an inventory, and will demand that articles in surplus be shut off at the source. It could be proved right now that not one life depends upon supplies in many categories. The Navy is still building battleships, which many believe will have small value, and crying for speed in aircraft carrier construction at the same time.

400 B-29s Monthly

WPB Chairman J. A. Krug, either cautiously or erroneously, gave the impression that B-29 Superfortress production is lower than it actually is. He implied the output is merely in excess of 200 a month. Actually it's above 300 per month, and by July - it will be more than 400 per month. It has been officially stated that the Army intends to put 2000 B-29s over Japan as of any given day by close of this year. To put up 2000 it needs more than double that number—to allow for planes in training use, for planes being serviced, and for planes in maintenance shops. The four plants building B-29s can build about 2800 by the year end, which, added to the more than 2000 on hand, will make possible the Army's objective.

Spotting the Air News

New Type Carriers

Aboard the U. S. S. Bon Homme Richard, at sea:—This heavy aircraft carrier is several days out (at this writing) from port on its way to war against Japan. The United States is now the major power remaining at war, and the Navy's aircraft carrier forces can compose one of our major weapons.

It would be hard to predict how the carrier will come out in its future competition with long-range land-based airplanes. But no matter how great the future range of the airplane, the carrier can always stretch the range or lighten the plane's fuel load by hauling it part way to its objective. Carriers will be an important concern of the metal-working industry for a long time to come.

Two Power Plants

This ship, which is a standard heavy, has two complete power plants, elaborately bulk-headed, so that either can function independently after the other has been damaged. Each plant consists chiefly of four boilers, two turbine engines, two reduction gears, drive shaft and propeller, and the usual condensers and other accessories.

One of the plants consists of the two outboard engines and their propellers, and the other the two inboards—so that, with either of them functioning alone, the thrust will be in balance.

The turbines are of the dual expansion type. Steam enters the smaller, high-pressure unit first, and then goes to the larger, low-pressure expansion turbine. The shafts of both turbine units run into the same gear box. The high-pressure unit has a ratio of 21 to 1 turn of the propeller shaft, while the low pressure unit has a ratio of 16 to 1. The propeller shaft turns at 150 r.p.m. at moderate ship speed. High speed cannot be published but it is very fast. The propeller shafting, which looks to be about 18 inches in diameter, is a special forging job, done by manufacturers who make heavy guns.

Reverse Turbine

There is a reverse turbine, coaxial with each low-pressure turbine, instead of the reverse gear you see on small boats, or the reverse action on reciprocating engines. The reverse turbine is idling backward except when it was needed. It doesn't look big, as compared with the forward driving turbines, but it has more power, using an enormous amount of steam, quite inefficiently. All four of the reverse turbines together can stop the ship, from moderate speed, in an amazingly short distance. Quick changes of speed are important in combat maneuvers.

Using By-product Heat

Steam pressure is about 600 pounds, and temperature varies between 500 and 900 degrees F. By-product heat of the boiler stacks and the exhaust are used to pre-heat feed water, fuel, and combustion air. Salt water cools the stills which convert salt water to boiler feed water, and cools the exhaust condensers. Salt water is taken in by a scoop on the ship's bottom when the ship is making fair headway, and by pumps when it is stopped or running slowly. Water enters the boilers at 265° F.

The ship's steam turbo-electric generating system has enough capacity to supply a big town. This is a stand-by diesel electric plant, which starts automatically if the turbine fails. The three airplane elevators and hundreds of other accessories are controlled by electric current. There is also a compressed air system, operated at more than 3000 pounds, which has many applications. The Navy does not permit any discussion of the airplane catapults, which are far more in use than is commonly supposed.

Bombers Carried, Too

The ship carries scores of deck-based guns: five inchers, that can elevate for attack on hostile aircraft and depress for use against surface objectives; 40-millimeter guns which have the same versatility; and 20-mm. machine guns bristling along the galleries. These guns are all mechanized beyond any pre-war concept. Ship's aircraft carry hundreds of 30 caliber, 50 caliber, and 20-mm. machine guns. Some of the ship's weapons throw shells whose fuses can be set to such sensitivity that they will detonate in rain.

Still larger than this type of carrier will be the new 45,000-ton *Midway* and *Roosevelt*, both of which have been launched but not commissioned. The total program of this type is five. They will carry twin-engined medium bomber and attack planes.

REQUIRED READING

WASHINGTON — Required reading for the metal-working industry is "Wartime Technological Developments" published by Senator Harley M. Kilgore's subcommittee on war mobilization. It contains 400 pages of solid information, ranging all the way from shop talk to industrial trends in the hoped-for new world. In addition to the hundreds of ready-to-use case histories, there is a wealth of suggestion for any imaginative executive or engineer to read between the lines.

More Black Widows Wanted—The Northrop Black Widow P-61 night fighters have been given additional range by the installation of four droppable fuel tanks of either 165-gallon size or 310-gallon size. Bombs might be shackled in place of the drop tanks. This additional striking power and the plane's four .50-caliber machine guns and 20 mm. cannon have resulted in the successful use of the plane as a day bomber. The plane will have a greater role in the Pacific theater, and expanded schedules call for 2,000 additional employees at Northrop's Hawthorne, Calif., plant.

Belgian Government to Control Future Machine Tool Imports

LONDON—It is reported that in the future Belgium's machine tool needs will be met by a system of government importing within the framework of U.N.N.R.A. This arrangement will have several important repercussions, one of which will be upon the status of prewar agents.

Thus far, British businessmen have questioned the legal position of Belgian agents who were not particularly effective in getting business in 1939, and who during the Nazi occupation have been selling equivalent goods of some continental make. The question is: Has the occupation and the agent's activities in favor of a rival continental make terminated his sole agency right, or is he to be regarded as still having a lien on the manufacturer's sale in Belgium?

Prewar Importers Upheld

Under the new arrangement, the Belgian government regards importers who possessed sole agencies at the beginning of 1940 as *prima facie* still possessing the same exclusive rights in 1945, and such importers have been asked to register their agencies at appropriate Belgian government offices. This may disappoint British or American manufacturers not too well satisfied with their prewar Belgian agents. But it has one advantage: The average manufacturer may not be able to visit Belgium for some time, and without making a personal investigation on the spot it would be difficult to be quite certain whether or not to change agents.

Orders obtained by importers of machine tools and other metalworking equipment in Belgium now have to be submitted to the Ministere des Affaires Economiques for approval. The authorities are naturally somewhat nervous about prices for such foreign purchases, because little is known about them in Belgium, and about the conditions under which British and American makers are prepared to supply equipment. Therefore, all orders will be placed on the express condition that they will be cancelled if the maker's price has risen by more than 100 percent over the year-end 1939 level.

3-Week Management Course Offered by Iowa University

IOWA CITY—The University of Iowa is again offering a three-week Management course from June 11 to June 29, 1945. The course is designed primarily for industry people desiring comprehensive training in Production Planning, Plant Layout, Motion and Time Study, Wage Incentives, and related subjects. It combines fundamental training with practical applications.

Names in the News

Carl W. Bettcher

C. E. Stephens

Carl W. Bettcher has been elected president of the Eastern Machine Screw Corp., of New Haven, Conn. In addition to his new duties, Mr. Bettcher will still direct sales and advertising. **Benjamin Green,** former president, was made chairman of the board.

C. E. Stephens, vice president of the Westinghouse Electric Corp., has retired from active service with that company after 45 years of service. Mr. Stephens was elected vice president in 1932 after serving as commercial vice president in charge of the districts in the Atlantic division.

Elliott G. Ewell of Mack-International Motor Truck Corp., New York, has been appointed vice president and manager of the southern division and will make his headquarters in Atlanta, Ga.

Clarence L. Collens is the new president of the Associated Industries of Cleveland, Ohio. **R. V. Mitchell** of the Harris-Seybold-Potter Co., Cleveland, was elected vice-president. Mr. Collens is associated with the Reliance Electric & Engineering Co., of Cleveland, as board chairman.

Timothy E. Shea, formerly chief engineer of the electrical research products division of Western Electric Co., New York, has returned to the company after four years' service as director of research for Columbia University Division of War Research, which operates under the National Defense Research Committee.

A. M. Andrews, veteran pilot, has joined the staff of the Briggs Clarifier Co., Washington, D. C., and Bethesda, Md., as one of the chief service engineers for the aviation division.

Joseph Wainwright has been appointed sales manager of The Boye & Emmes Machine Tool Co., Cincinnati, Ohio.

Gerard H. Welch has been appointed assistant to the manager of the Switchgear and Control Division of the Westinghouse Electric Corp., Pittsburgh, Pa. **W. E. Miller** has been appointed vice president in charge of the law and patent department, and **Ralph C. Stewart,** vice president in charge of Lamp and Lighting Divisions.

George Rodgers has resigned as president of Albina Engine & Machine Works, Portland, Oregon, after 39 years in shipbuilding and ship repair industries. He has been succeeded by **L. R. Hussa,** former vice president.

Russell C. Duncan has resigned as deputy director in charge of surplus sales and merchandising, Department of Commerce, Washington, D. C. He will return to head the R. C. Duncan Co., of Minneapolis and St. Paul, Minn.

O. S. Linderose, Detroit tool engineer, has been appointed manager of the Rite-Way Tool and Mfg. Co., Detroit, Michigan.

Walter H. Gebhart has been elected a vice president of Henry Disston & Sons, Inc., Phila. Mr. Gebhart, who for the past two years has been manager of the domestic sales division, started with the company 35 years ago.

Dr. C. R. Austin

H. A. Schimberg

Dr. C. R. Austin, professor of metallurgy at Pennsylvania State College, has accepted an appointment as assistant to the president of the Meehanite Metal Corp., New Rochelle, N. Y.

H. A. Schimberg has been promoted to director of purchases of the LaPlant-Choate Manufacturing Co., Inc., Cedar Rapids, Iowa. He will have the responsibility for all purchases and procurements and in addition will supervise the work of the Sub-contracting Dept.

C. H. Clark, vice president of Robbins & Myers, Inc., Springfield, Ohio, will retire at the end of this fiscal year. **A. W. McGregor** has been elected executive vice president, **F. W. Smith,** vice president, and **W. J. Helmer,** general sales manager of the company.

Gordon S. Gillespie has been appointed comptroller and secretary of Adel Precision Corp. He formerly was secretary-treasurer of Diamond Iron Works, Inc., and Mahr Mfg. Division, Minn.

William G. Bostwick has joined the Precision Welder and Machine Co., of Cincinnati, Ohio, as chief electrical engineer. He was formerly chief electrical engineer of Federal Machine and Welder Co., Warren, Ohio.

Joseph H. Hayden has been promoted to the position of vice president and **Willia H. Watkins** has been named controller and assistant treasurer of the Hewitt Rubber Corp., Buffalo, N. Y.

Roy Crawshaw has been advanced to the position of manager of engineering and sales of Western Gear Works, Seattle, Washington.

J. Robert Van Pelt has been appointed a member of the Battelle Memorial Institute, Columbus, Ohio to head the department of research education.

Earl W. Pierce has been appointed chief metallurgist of the Carnegie-Illinois Steel Corp., U. S. Steel subsidiary, in Chicago. **Tom J. Peters** was named assistant to the general superintendent at the South Chicago plant.

F. F. Rose who has been connected with the ACF Sales Department of the American Car and Foundry Co., New York, since 1899, has retired as vice president of the company.

OBITUARIES

Wilson J. Tallman, president of the National Tool and Machine Co., Rochester, N. Y., which he organized 23 years ago, passed on at his home last month. He was also president of the Tool, Die and Special Machines Assoc., Inc.

John B. Harlow, 61, contract license manager of the Electrical Research Products division of Western Electric Co., passed away at his home on May 15. Mr. Harlow had more than 35 years of service in the Bell System. He resided in Montclair, N. J.

E. R. Fellows

E. R. Fellows, pioneer tool builder, and founder and president of the Fellows Gear Shaper Company, died May 22. He established his company in 1896 to build gear-cutting machines developed under his patents. In 1899, Mr. Fellows received the John Scott Medal of the Franklin Institute of Philadelphia for designing and manufacturing a machine for grinding the gear-cutter. His original shop of seven employees has since become one of the largest companies in the world in its field.

Mr. Fellows held some 35 patents on gear manufacturing equipment.

Mr. Fellows was highly regarded by his employees as is evidenced by the fact that there are 110 men in the company who have been employed continuously for a quarter of a century or more.

Royal F. Ketchum, 69, died at his home May 10. Vice president of the Kansas City Rubber and Belting Co., Mr. Ketchum had been a resident of Kansas City, Mo., for over 40 years and was a veteran of the Spanish American war.

Alpha M. Brown, president of the Brown Tool Co., Cleveland, Ohio, for 25 years, died May 15 at his home in Cleveland, Ohio.

Emil C. Traner

Emil C. Traner, 68, died at his home in Rockford, Ill., after an extended illness. Veteran Rockford industrialist and supervisory board chairman of the Rockford Clutch Division of Borg-Warner, Rockford, Ill., Mr. Traner retired last November as president and general manager of Rockford Clutch, formerly Rockford Drilling Machine Co., which he joined as secretary in 1916.

Dr. E. W. Engle, 57, research and consulting metallurgist for Carboloy Co., Inc., died at his home in Detroit, Mich., on April 26. Dr. Engle was recognized as an authority on the subject of tungsten and tungsten carbides.

Guilford Duncan, 67, head of the firm, The Ludlow-Saylor Wire Co., St. Louis, Mo., died May 9. A graduate of Yale University, Mr. Duncan succeeded his father, the late William Duncan, pioneer railroad man, as president of Ludlow-Saylor in 1911.

BUSINESS ITEMS

C. E. Wilson, president of **General Motors Corp.,** Detroit, Mich., has announced the purchase of a tract of land located in Jackson City, Mo., by General Motors, for postwar use as a site for a plant.

The corporate name of **Zimmer-Thomson Corp.,** Long Island City, N. Y., has been changed to **Thomson Industries, Inc.**

The Gothard Manufacturing Co. of Springfield, Ill., designers and manufacturers of pilot light assemblies for electronic and electrical equipment and appliances, is enlarging its facilities through the erection of a new plant to include an enlargement of the company's engineering and research department.

The Culpeper Foundry & Machine Co. plant in Culpeper, Va., has been sold to **G. M. Burgess** of Alexandria, Va. The plant had been running full time on war contracts until the recent death of its manager, **Charles Walker.**

Borg-Warner International, Chicago, Ill., in line with its aim to create a single source of supply for foreign importers of automobile, truck, and tractor functional parts, has added **AP Parts Corp.,** Toledo, Ohio, as a new representative, as well as **Owatonna Tool Co.,** Owatonna, Minn., manufacturers of gear and bearing pulling equipment for automotive and industrial applications.

The new home of the **Propulsion Engine Corp.,** is being built in the Fairfax Industrial district, Kansas City, Kansas, to be occupied July 1.

The Stow Manufacturing Co., with headquarters in Binghamton, New York, have completed arrangements to open a service branch at 1401 Third St., San Francisco, Calif.

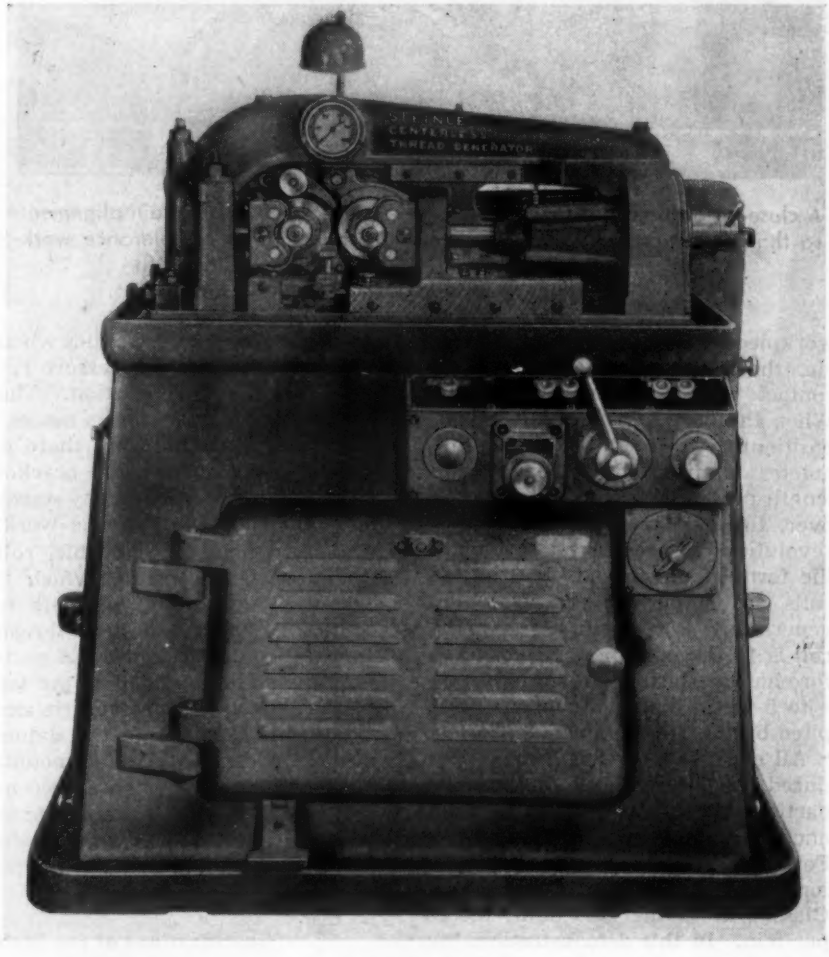
Shop Equipment News

Class 4 Fit in Wide Pitch Range Produced by Centerless Thread Generator

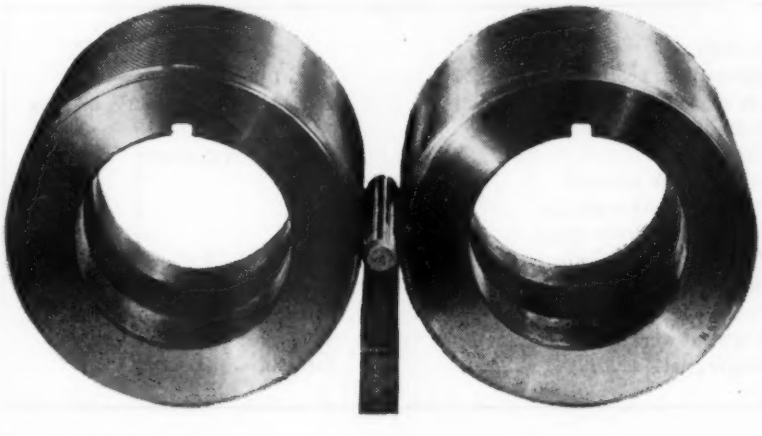
Precision threaded parts in a wide variety of pitch diameters can be produced on the Steinle Centerless Thread Generator at high production rates. This machine was designed by Leo C. Steinle of the London firm bearing his name, and has been used in England for the past three years for the manufacture of highly accurate threaded aircraft components and other close-tolerance threaded parts. Now the identical machine is available in the United States from The Steinle Machine Co., 63 Allyn St., Hartford, Conn., which has procured duplicate tooling from the English company and has made its own manufacturing arrangements.

The Steinle Thread Generator uses the principle of the centerless grinder, in that a workrest positions the blank slightly below the centers of two circular thread-forming rolls. These hardened steel rolls have their peripheral faces ground with a precise, negative reproduction of the helix angle, pitch and thread form to be generated. One roll revolves about a stationary axis, but the sizing roll is mounted upon a slide and fed automatically into the work for a pre-determined depth.

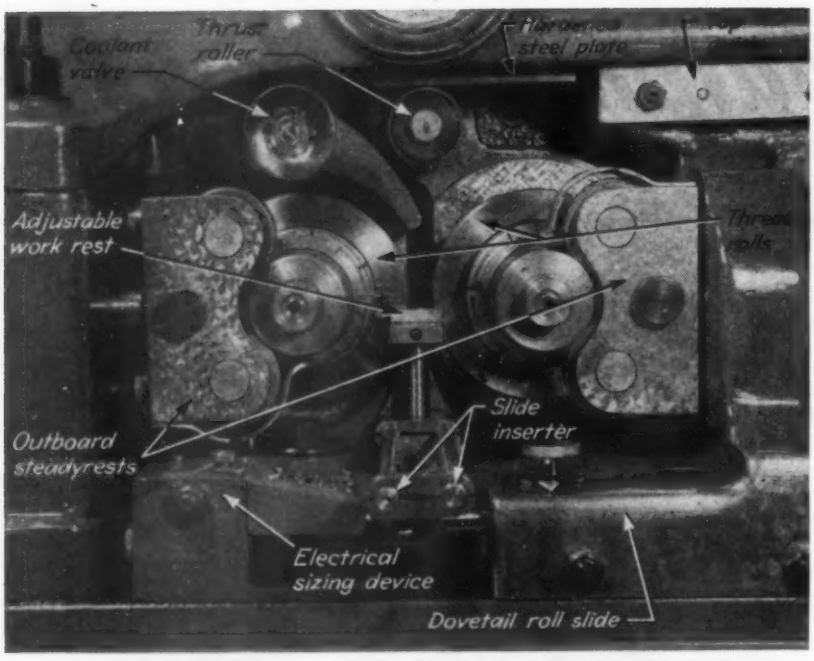
There is no axial movement of the



First available size of the Steinle Centerless Thread Generator has capacity from 1/8-in. fine threads to 1-3/16 in., 9-pitch British threads on heat-treated alloy steels and larger diameters on the mild steels



A workrest holds the blank slightly below the centerline of the two thread-generating rolls. No axial movement of the workpiece occurs while the thread is being cold formed



A close-up of the roll assemblies shows the steps taken to maintain alignment, so that deflection will not arise to cause production of off-tolerance workpieces, even though made to better than a Class 4 fit

workpiece during the generating cycle, the blank merely revolves in contact with the generating rolls. When the part is removed from the positioning workrest, the outside diameter is threaded to exactly the length presented to the rolls. Moreover, the part may make as many revolutions as necessary to complete the form of the thread. Multi-start rolls are employed; that is, when generating a ¾-pitch thread, the roll is 4½ in. in diameter and therefore has six starts. Rolls range from 4 to 5 in. in diameter and are supplied by the Steinle Machine Co.

All classes of threads can be produced, but the Steinle machine is particularly adapted to close-tolerance work at high production rates. For example, 7/16-20 threads 2¼ in. long were made to better than a Class 4 fit at the rate of 20 pieces per min. In this demonstration, the pitch diameter was held to 0.0005 in. as against a tolerance of 0.0013 in. and no taper was discernible over the entire length when checked with a comparator graduated to 0.0005 in.

Design characteristics are responsible for the accuracy and speed of the Steinle machine. Upon the base there is mounted a heavy, ribbed plate that acts as a datum surface for erecting the two end columns, which are tied together by an overarm.

This framework assures squareness of alignment of the roll assemblies, but additional features prevent twisting of the assemblies when they are subject to the pressure required for thread generation. The left-hand roll is fixed and is mounted on a heavy bracket, but there is provision for swiveling the bracket to eliminate or provide any taper that might be desired on the work.

The right-hand, or movable, roll is mounted upon a slide, which is powered by hydraulic cylinders to feed this roll to the desired thread depth and return it to the out position. The slide is guided at the top by a gibbed way on the overarm and by dovetails fastened to the datum plate. In addition, the slide mounts a hardened steel roller on an eccentric stud. The roller bears against a hardened steel plate fitted to the underside of the overarm and prevents any tendency for the movable roll to lift.

Roll spindles are mounted front and rear in straight roller bearings. Outboard support against generating pressure is provided by steadyrests consisting of two pivotally mounted hardened rolls. This feature avoids any roll-spindle deflection.

Drive to the roll spindles is obtained by a motor driving flexible belts running over sheaves. These sheaves are mounted on worm shafts which drive wormgears at the rear of the spindles.

Work sizing is controlled automatically by a heavy stop bar, which is preset with a micrometer dial to determine the distance between the rolls at the end of the slide stroke. An electrical trip mechanism operates in conjunction with the dead-stop bar and returns the slide to the out position.

The workrest is mounted on a semi-circular dovetailed bracket, and is adjustable for height within the range of the machine. Although the maximum length of thread that can be generated is 2¼ in., the thread can be put at various locations on the blank by means of an end stop on the workrest.

The base has a two-compartment tank for hydraulic-oil and coolant sumps. The tank is fitted with four rollers so that it can be run out on rails for cleaning. Both the hydraulic and coolant pumps are located on top of this tank.

All electric control devices are mounted on the rear of the access door to the base. Thus any electrical repair work is simplified. Moreover, the control panel is a unit assembly located at the right-hand side of the apron and can be disconnected quickly.

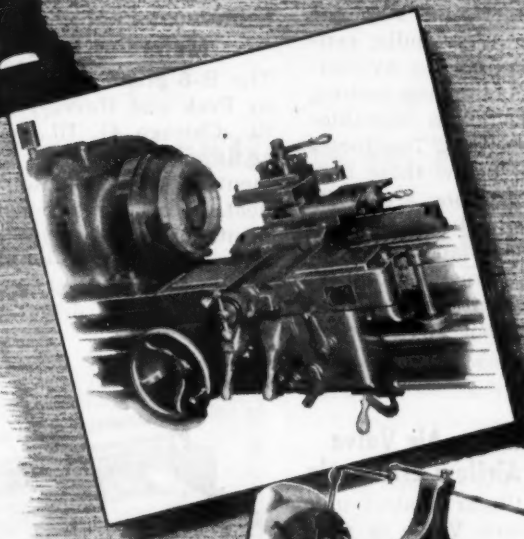
Simple controls help the operator to maintain high output. There are three groups of buttons on the panel with functions as follows: right-

Specifications of the Steinle Centerless Thread Generator

Capacity:	
High-tensile, heat-treated stock	⅛ to 1⅜ in.
Soft steels and non-ferrous metals	up to 2¼ in. dia. by 2¼ in. long
Hydraulic pressures	0 to 2,000 lb.
Size of rolls	4 to 5 in. in diameter
Coolant tank capacity	7 gal.
Hydraulic tank capacity	6 gal.
Roll-spindles drive motor	3 hp.
Hydraulic-pump motor	2 hp.
Coolant pump motor	¼ hp.
Floorspace	47 in. long by 37¾ in. wide
Height of work spindles	40⅝ in.
Weight, net	2900 lb.

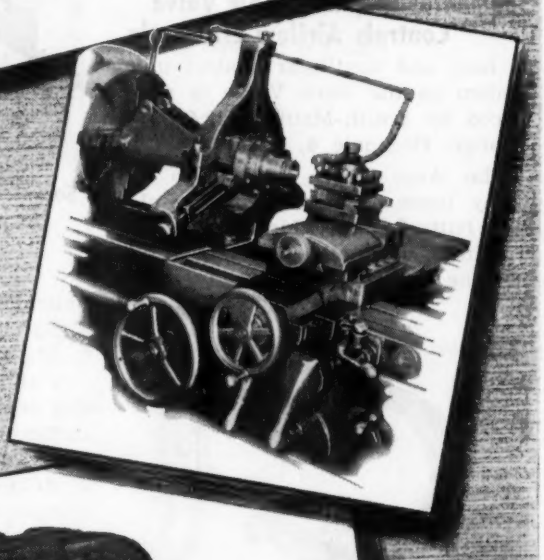
LODGE & SHIPLEY LATHES AT WORK—

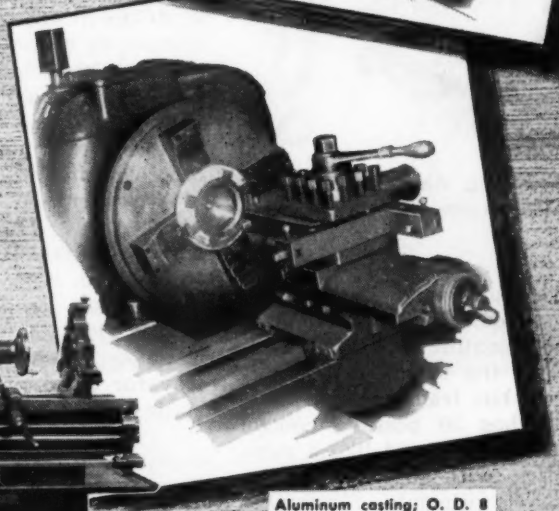
on castings . . . aluminum and steel

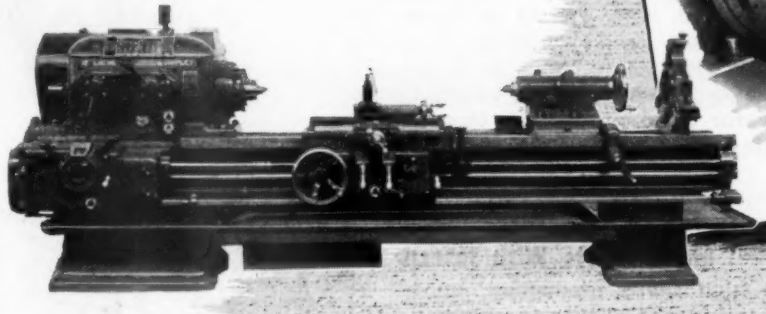


Aluminum casting; O. D. 15½ inches, bore 9¼ inches; weight 4½ pounds; Operation—face, bore, turn, and form grooves; speed 216 rpm, .008 inch feed.

Steel casting; length 27⅛ inches; weight 118 pounds; Operation—face, turn, bore, counterbore, ream and groove; speed 169 rpm, .006 inch feed. Bores and counterbores must be concentric within .001 inch.







Aluminum casting; O. D. 8 inches, bore 4½ inches; weight 1.3 pounds; Operation—face, bore, turn, and form grooves; speed 216 rpm, .008 inch feed.

To machine tough castings of intricate design is no job for an ordinary lathe. Illustrations show several castings which must pass the most critical inspection at the Erie Works of the General Electric Co.—machined on the new Lodge & Shipley 18, 20, 22 inch Lathes.

Completely new in every part, these L & S Lathes set up improved standards of accuracy, production and smooth operation. A wider range of speeds, feeds and threads permit full use of all cutting tool possibilities, increase versatility of these lathes.

Bring your lathe problem to L & S Engineers—they're backed by 53 years of specialized lathe experience. For further details on these new lathes, write on your company letterhead for Bulletins Nos. 503, 605.

THE LODGE & SHIPLEY MACHINE TOOL CO.

CINCINNATI 25, OHIO, U. S. A.

L & S LATHES

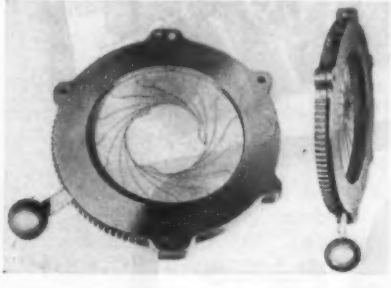
ENGINE—TOOL ROOM—AUTOMATIC—OIL COUNTRY LATHES

hand buttons—start and stop the main drive motor for spindle; central buttons—start and stop hydraulic pump and coolant-pump motors; left-hand button—return movable-roll slide to out position. Two meter valves are placed below these buttons and their functions are: left-hand valve—to control variable feed rate to slide; right-hand valve—to control generating pressure applied. The center lever controls mechanical operation. A foot switch stops all motors.

Segmental Diaphragm Air Valve Controls Airflow Efficiently

A heat and ventilator control unit known as the Aero Valve is produced by Smith-Mautz Co., 230 S. Orange, Glendale 4, Calif.

The Aero Valve is said to be many times as efficient as the old type butterfly unit which it replaces. The unit originally was developed for the aircraft industry. Its corrosion resistance and strength assure long, trouble-free operation for air or heat control application, particularly in the marine, air conditioning, or bus transportation field. The unit has 36 positive control stages, and is designed like a camera shutter, with 15 to 18 shutter segments. Its principle of assembly uses a minimum of wearing parts. Aluminum die cast cover and housing have anodized finish; all other parts are made of stainless steel. Knob on the control is an AN standard part.



Shutter of the Aero Valve gives positive control of airflow

The diaphragm can be operated by remote controls and flange mountings provided to specification.

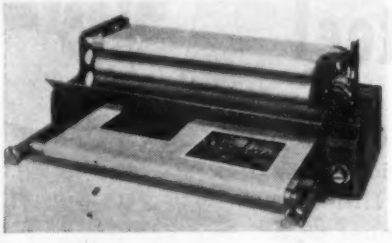
The Aero Valve has passed a 50-hour concentrated salt spray test and operates without efficiency loss at temperatures varying from 65 F. below zero to 400 F. above.

Available in five model sizes with openings from two to seven in. dia.

Continuous Photo-Print Dryer Maintains Even Temperature

The B-8 photo dryer manufactured by Peck and Harvey, 4327 Addison St., Chicago 41, Ill., operates with additional electrical heating elements to assure maintenance of even heat. It dries matte or semi-matte prints or glossy prints as well as blue or black-and-white prints.

Thermostatic control is available. Variable-speed drive motors and controllers permit instantaneous speed changes over a range of 6 in. to 3½ ft. per minute.



Seamless woven conveyor belt protects prints from scratches

A chromium plated copper drum that finishes photos with a high gloss surface is included. A specially woven seamless band has no joints to deface prints. The pressed steel framework cannot warp from effect of heat. Steel-clad, refractory insulated, Nichrome heaters, nickel contacts, and asbestos insulated nickel wire are used in the heating and control unit.

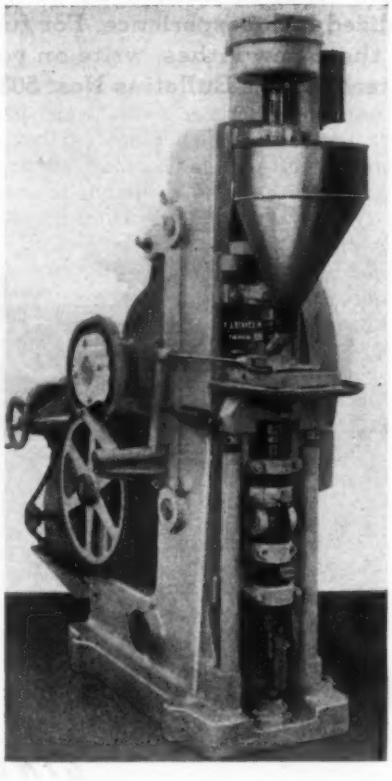
Two sizes are available, 26 and 44 in. widths. The 26 in. dryer, 110 volt a.c. or d.c. is 40 in. long, 28 in. wide, 13 in. high. The 44 in. dryer, 110 volt a.c. or d.c. is 58 in. long, 28 in. wide, 13 in. high. Both are complete, provided with receiving tray for dried prints. The thermostatic control is optional.

Powder Metals Cam Press Makes Parts With Inserts

For high speed production, up to 45 strokes per minute in automatic operation on the usual run of work, and to operate also as a start-stop press in making parts with inserts, the F. J. Stokes Machine Co., Philadelphia 20, Pa., is offering the G-2 Press. This machine is of 12 tons capacity and of design similar to that of the model G. Press is intended for making small machine parts such as gears, internally or externally splined bushings and ordnance components, carbide tool bits and drawing dies, carbon brushes, brushes with pig-tails, iron cores with threaded shafts molded in place and similar parts.

As a start-stop press the operator places the insert in position and pushes a button; the press measures the charge in the usual manner, compresses the material around the insert and ejects the finished piece, leaving the punch in the "up" position for the next cycle. The machine is cam operated, with independent cam control of both upper and lower punch movements. The die table is braced to take the full rated tonnage of the machine, and pressures applied through the punches may be simultaneous or non-simultaneous. An independent secondary lower punch applies pressure up to 2½ tons and may be used as a fixed core rod. The upper punch will stay out of the way during a third of the cycle, to facilitate feeding, and is timed to first descend rapidly and then slowly compress the material with controlled motion. A built-in hydraulic equalizer assures uniform pressure and uniform density of each piece.

Powered by a 5 hp. variable speed drive, the machine has a capacity up to 45 pieces a minute, depending upon the material and the nature of the part being formed. Maximum die fill is 4 in. Maximum size piece is 1½ in. or equivalent area.



Lower punch may be used as a fixed core rod or secondary ram

100 CASE HISTORIES

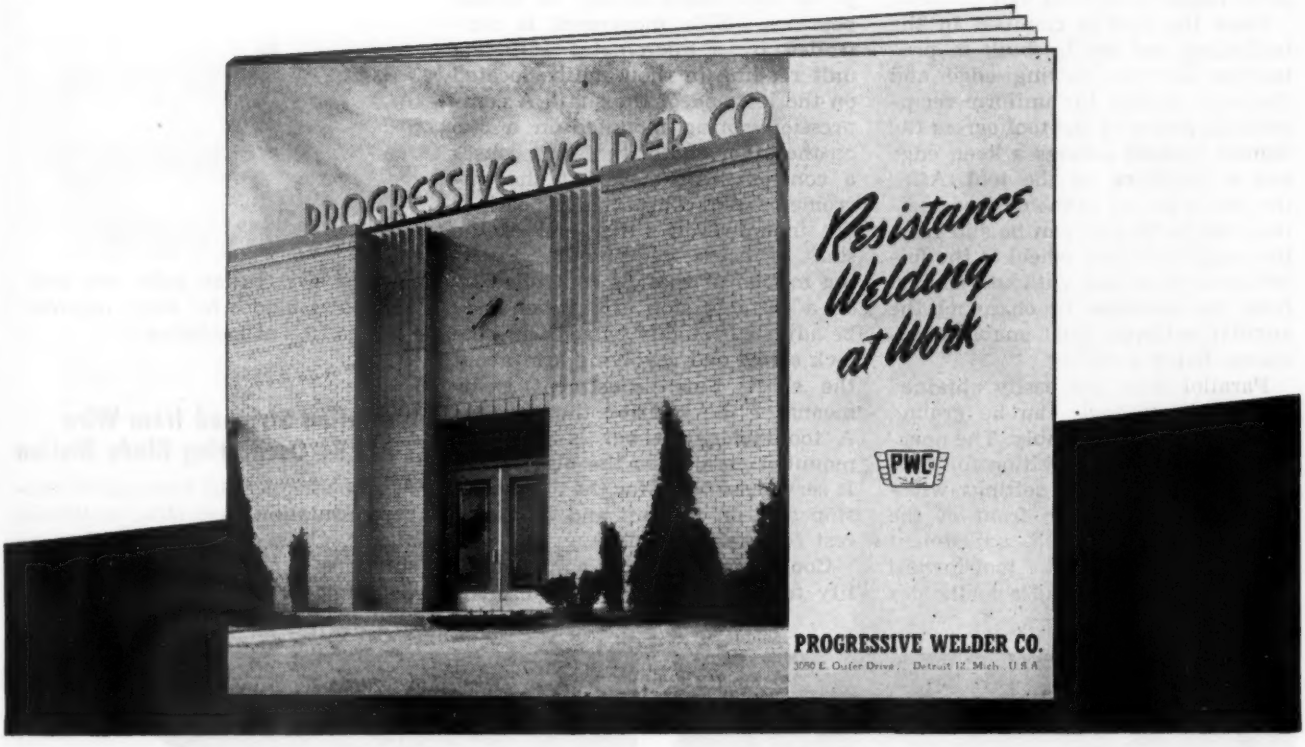
of typical applications in Industry of

"PORTABLE" WELDING

1. Portable machines
2. Push guns
3. Scissors guns
4. "C" type guns
5. Pinch type guns
6. Special guns
7. Portable Seam Welders

"STATIONARY" WELDING

1. Pedestal Spot welders
2. Rocker arm welders
3. "Temp-A-Trol" welders
4. Projection welders
5. Multi-spot welders
6. Seam welders
7. Special Uses of Welders



Write for your copy on your Company Letterhead. Ask for it by name. "RESISTANCE WELDING AT WORK" or by number WP-44

On all kinds of industrial products: automobiles, stoves, refrigerators, containers, aircraft, etc. . . . All kinds of metals: aluminum, stainless, carbon steels, alloy steels . . . In heavy gages and light gages . . . On all kinds of shapes.

Plus a section on Welding & Assembly Fixtures

No metal fabricating plant should be without one of these idea-provoking 60-page books . . . the story of *how* resistance welding can be and is being used to simplify construction, cut costs, speed production and improve the value of finished products. Includes many new uses developed as a result of the war.

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Tool Grinder Grinds and Laps Carbide Tools to Precision Form

A precision tool grinder for carbide tool grinding has been developed by E. F. Hager & Son, 98-02 217 Lane, Queens Village 9, L. I., N. Y. Based on the fundamental principle employed in Swiss-type grinders, the Hager machine grinds or laps carbide cutting tools for lathes and screw machines as well as toolbits with carbide tips inserted in milling cutters. All angles can be rough and finish-ground or lapped on the diamond wheels by mechanical settings in less time than rough grinding alone requires on hand tool grinders.

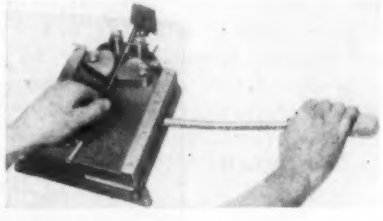
Once the tool is clamped in the toolholder and set by built-in protractors for the cutting edge and clearance angles, the uniform reciprocating action of the tool across the diamond wheel assures a keen edge and straightface on the tool. After the tool is locked in the desired position, the toolholder can be slid from the rough-grinding wheel to the finish-grinding wheel without removal from the machine or changing the angular settings, thus enabling accurate finish grinding.

Parallel sides are easily obtained and duplicate tools can be ground and used interchangeably. The operator can reach any position for rake or clearance angular settings without moving from the front of the machine. A fine feed adjustment governs the feed of the tool toward the cutting surface and a toolholder rest bar prevents the tool from digging into the grinding wheel.

The grinding spindle is precision ground and supported on two felt-sealed ball-bearings. End play of the grinding spindle is eliminated by its design. The heavy center of the spindle and rigidly constructed cabinet prevent vibration. Spindle speed of 3,400 r.p.m. is attained through a V-belt which transmits power from a ½ hp. motor.

The toolholder is mounted on a hardened and ground shaft which pivots and slides axially in bronze bearings. Side movement is controlled by a micrometer adjusting unit reading in thousandths located on the left end of the shaft. A compression spring mounted in a cup on the other end of the shaft causes a constant thrust against the micrometer nut. Thrust ball bearings are mounted on either end of the shaft to insure free pivoting. Pivoting motion of shaft is controlled by an adjustable stop arm which may be adjusted roughly by releasing the lock screw and revolving arm about the shaft. Fine adjustment is by means of the knurled thumbscrew. A toolholder rest bar is provided, mounted parallel to the pivot shaft. It serves as a stop for the adjustable stop arm on the left and as a stop rest for the toolholder.

Coolant is supplied in ample quantity to prevent overheating carbide while removing material. Chips and carbide particles are washed down into the tank. Coolant system allows for two stages of settling. Coolant is pumped from one section of the tank up a riser pipe and through shut-off cocks to any of the four grinding faces of the wheels. Splash pan collects the coolant and directs it through the drain channel where it passes through the front section of the coolant tank. A large percentage of the grit particles settles to the bottom of this first section. Separate drain plugs are provided to clean sediment from each compartment of the coolant tank. A relief valve in the coolant system protects the pump against over-heating when shut-off cocks are closed.

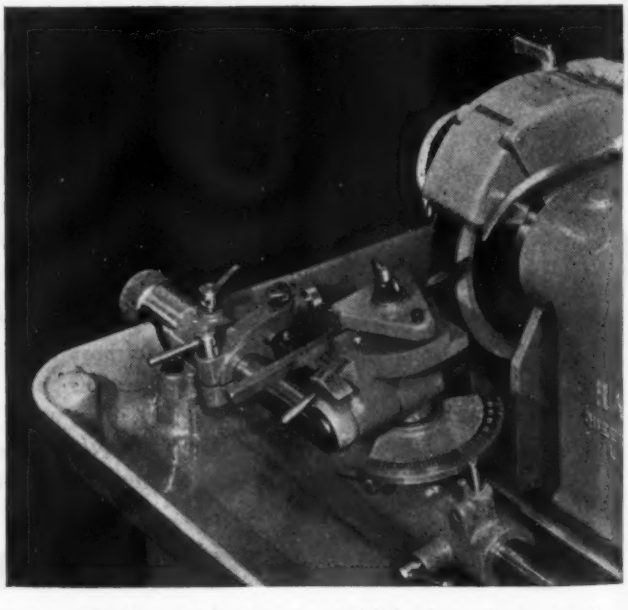


Single lever action pulls wire and oscillates blades for clean removal of insulation

Insulation Stripped from Wire By Oscillating Blade Motion

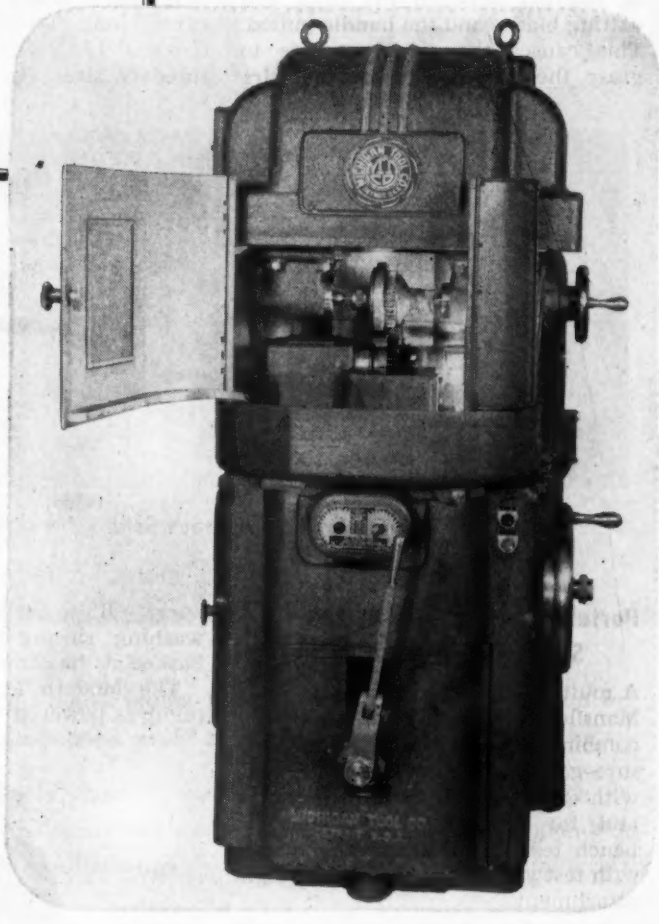
A wire stripper for removal of rubber insulation, asbestos, synthetic, plastic, glass, cambric and other insulations is announced by the Ideal Commutator Dresser Co., 1446 Park

The grinder is mounted on a cabinet stand that is fitted to hold accessories and extra tool blanks



Once the proper setting is established on the controls, the machine will duplicate tools without attention

cut GEAR SHAVING TIME *in half*



WITH "UNDERPASS" SHAVING

Michigan Rotary "Underpass" type gear finishers—a GEAR PRODUCTION HEADQUARTERS development—are already doing just that. They eliminate the necessity for both cutter infeed and transverse cutter or work reciprocation. One pass of the cutter, usually, and the gear is finished. Furthermore, underpass finishing can be used with ease on close-shoulder gears.

Completely automatic in operation. Virtually eliminates the human element in obtaining the highest of precision at low cost. For further information just ask for

"Data on
Underpass Shaving"

OTHER GEAR PRODUCTION HEADQUARTERS PRODUCTS INCLUDE

Rack type gear finishers for highest precision and lowest cost per piece in mass production

Rotary Gear Finishers for gears from ¼ inch to many feet in diameter

SHEAR-SPEED gear shapers which will cut a gear as fast as you can shave it

Gear Lappers; SINE-LINE gear and gear tool checking equipment; all types of spur and helical gear cutting tools.

ORIGINATORS of GEAR SHAVING

MICHIGAN TOOL COMPANY

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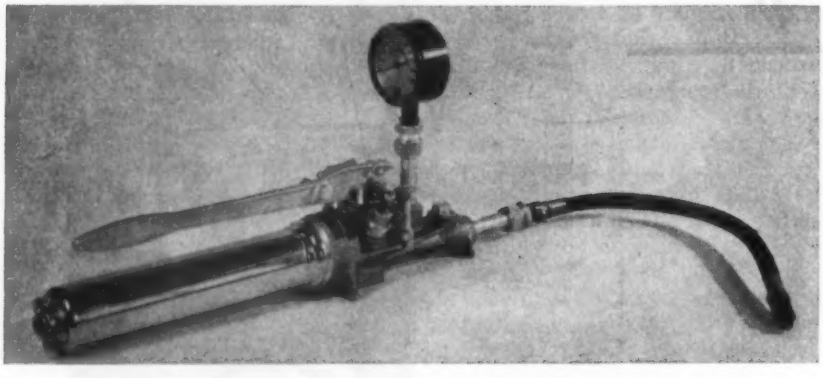
BUY U.S. BONDS STAMPS

Ave., Sycamore, Illinois. Any length of wire or cable, up to ⅝ in. diameter, single or parallel conductor, can be stripped. Plain or grooved blades are used depending upon the type of wire. Parallel wire, heater cord, inner conductors and POSJ cord can be stripped with plain blades. The grooved blades are intended for rubber-covered and weather-proof cable.

To use the stripper the wire is laid in position between the jaws and cutting blades and the handle pulled. This causes the gripping jaws to grasp the wire and draw the wire through the oscillating blades. The pulling action is in a straight line, eliminating scraping and nicking of wire. The jaws automatically center and grip any diameter of wire without manual adjustment. Jaws instantly release wire at end of stripping stroke. Blades open automatically to receive wire when lever is pushed forward. Blades are quickly interchangeable. The adjustable stop provides for length of stripping, or it can be removed when extra long stripping is desired. Grooved blades are available in 15 standard sizes.



Mounting lugs are provided to attach field or bench testing fixtures

Portable Hydrostatic Tester Seals Against Grit in System

A multi-purpose tester developed by Mansfield & Green, Cleveland, Ohio, combines, in a single unit, a pressure-gage tester that can be used with equal facility for bench testing and for testing in the field. On bench testing, the unit can be used with test gages or with a dead weight attachment.

A doubly sealed check valve completely eliminates leakage and loss of pressure even with grit in the system, whether using oil or water and for pressures up to 10,000 lb. per sq. in. Principal uses of the testing unit include testing and repairing of pressure gages and instruments, the setting of relief or other pressure-actuated valves and general hydrostatic testing.

Automatic Machine Speeds Industrial Parts Washing

An automatic washer for industry has been put on the market by the Modern Mechanic Co., 122 So. Michigan Ave., Chicago 3, Ill. The heavy-duty model includes rinse vats for production-line work. One man can operate three baskets of metal parts, washing, rinsing and draining each basket at the same time.

The Modern Mechanic's impeller pump is powered with a ½-hp., single-phase motor and forces a ton of solvent per minute over parts to be washed. Sixty-five gallons of washing liquid are used and it is automatically screened by baffle-and-grill for re-use. Service required is reduced to a minimum because there are only three moving parts: a motor, impeller and V-belt.

Removable baskets speed loading

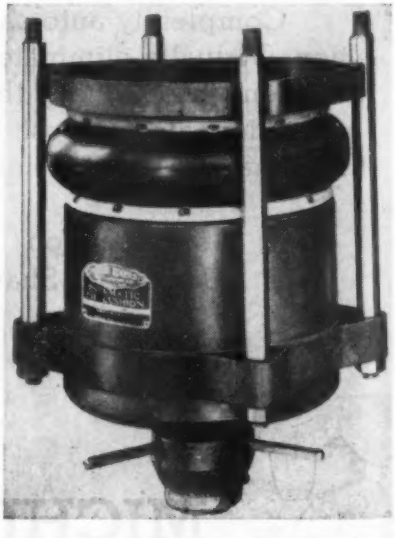
Pneumatic Die Cushion Uses Rubber Bellows for Snubber

The Dayton Rogers Manufacturing Co., 2835 12 Ave. S., Minneapolis, Minn., has developed a pneumatic die cushion of a "bellows" type design which employs a molded synthetic-rubber bellows in place of the conventional piston and cylinder air jacks. The synthetic-rubber bellows absorbs the die cushion travel of the hardened and ground pressure pad. The bellows-type die cushion, under test, has flexed in excess of 3,000,000 cycles without any appreciable deterioration of the synthetic rubber moldings and will stand working pressures up to 300 lb. per sq. in.

The synthetic-rubber molding is not affected by oil in the air line, grease or other drawing compounds. The air leakage experienced with the conventional-type equipment is eliminated due to the balloon-tire bellows used in the construction and the loss of air pressure on a given unit is less than that of the average balloon tire. No regulating air reducing valve is necessary. The die air jack is charged from the shop air line to a predetermined pressure recorded on a pressure gage. Such pressure can be retained over the entire run of a given part with no loss in pressure.

The bellows air cushions are made in sizes from 5 to 12 in., have drawing capacities up to 5 in. and can be used on all deep-drawing jobs within their capacity, as well as pressure pad control of forming dies.

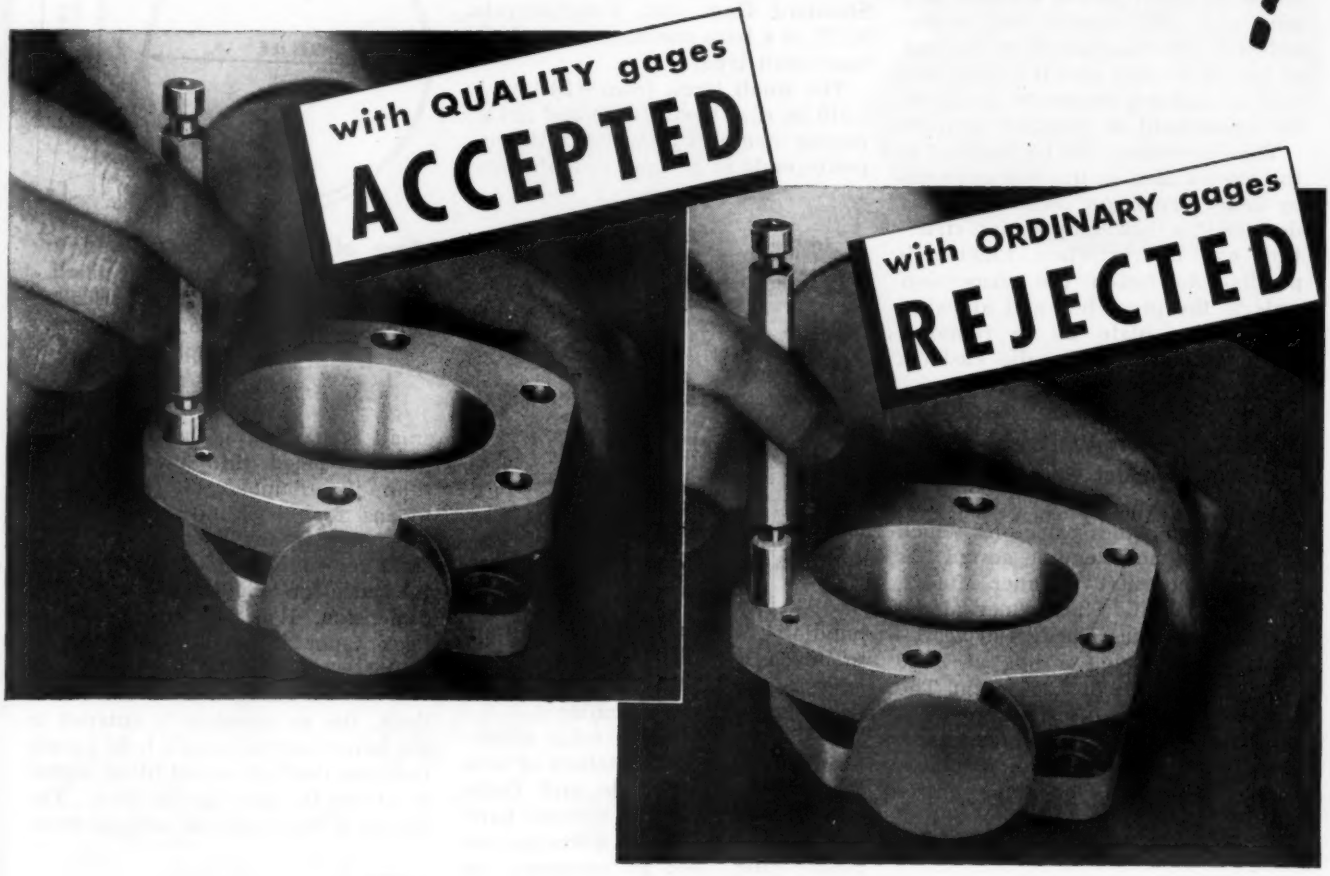
Off-center loading on the pin pressure pad is compensated for by a heavy-duty, pad guide stem which also serves as an adjustable feature. This allows the operator to stop pad



Lower handwheel adjusts pad

IT'S IMPORTANT TO YOU

to consider THIS *Cost Factor!*



Frequently, gage quality alone marks the difference between rejection or acceptance of satisfactory parts . . . between production profit or loss.

In the part illustrated, the holes may be extremely close to, but within, required limits. Using an ordinary new gage, in which usual allowance for wear has been incorporated, the "go" member may indicate the hole to be undersize. In a high quality gage . . . made of wear-resistant material . . . wear allowance is eliminated in its manufacture. It is *accurate* from the *first* inspection . . . and throughout its long, dependable service life. If the hole is actually within specified tolerances, it will be gaged correctly and the results of expensive man-hours and machine time will not be consigned to scrap.

This same initial accuracy in a gage . . . this same accuracy which is retained throughout the life of the gage . . . also provides quality control which consistently permits higher standards of precision in production departments. So, from every standpoint, good business judgment dictates the use of only the *best* gages obtainable. Lincoln Park produces them.

ARMY E NAVY

LINCOLN PARK INDUSTRIES, INC.

Successor to The Lincoln Park Tool and Gage Company and Carbur, Inc.

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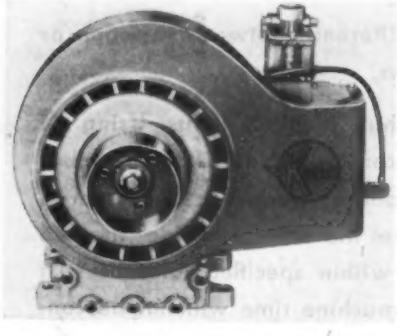
at a predetermined height, compensating for bolster plate thickness variation and the increase or decrease in length of the pressure pad pins. All adjustments are maintained by the handwheel on the end of the guide stem and it is provided with a locking means to maintain the adjustment in constant position.

The die cushion can be fastened to the bolster plate of the average press by four suspension rods. It is also designed so that a supporting structure can be furnished, making it possible to fasten the suspension rods to the press bed and allowing the bolster plate to be removed without removing the die cushion.

Six Horsepower Available From Compact Gasoline Engine

A 5-hp, all-purpose air-cooled engine that embodies principles which are new in small engine design has been announced by Kinner Motors, Glendale, Calif. The Kinner Model AB-3, is an air-cooled, 4-cycle, L-head engine rated 5 hp., at 2,600 r.p.m., and 6 hp., at 3,250 r.p.m. The single cylinder is horizontal and detachable, making maintenance easier. Bore is 2¾ in. stroke, 3 in. displacement, 17.3 cu. in. The unit requires 2.4 cu. ft. of space.

Aluminum alloy is used in crank-



Cooling shroud incloses all parts above the mounting base

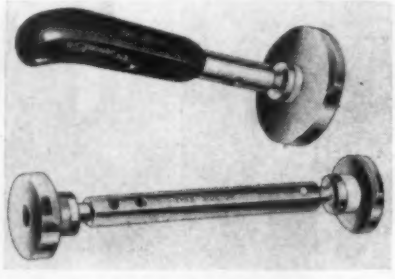
case, piston, head, and rear cover. Light weight of the "Busy Bee" is attractive to equipment manufacturers who are building portable units, and provides improved cooling. Power take-off shaft is 1 in. dia. and rotates counter-clockwise facing the shaft.

Torque curve on the engine is practically flat. Bearing surfaces are large, with bearing pressures kept low. Full pressure lubrication is supplied by a positive, high pressure oil pump. All bearings are hardened to give longer wear.

Spherical Surfaces of Gages Give Accurate Check of Bores

The DuBo gage, a product of the Standard Gage Co., Poughkeepsie, N. Y., is a bore checking gage of the fixed limit type.

The small sizes, from 0.240 in. to 1.510 in. dia., have the go and not go gaging members attached to the opposite ends of a light weight metal



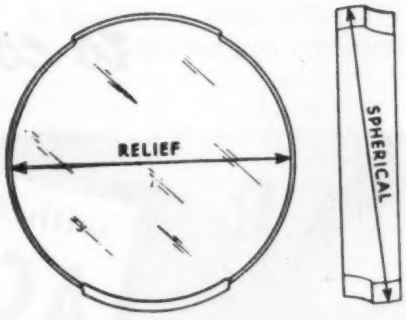
Gage mountings are arranged for ease in handling and efficient use

handle. The larger sizes, from 1.510 in. to 6.010 in. dia., are single end gages, individually mounted on palm-fitting plastic handles.

Both types utilize a color identification system. Go members of both the double and single end DuBo gages are marked with a broad band of green enamel under a transparent plastic ring. Not go members are similarly identified by brilliant red bands. The handles of the double end gages also carry corresponding dots of color. The correct gage head therefore may be recognized regardless of the position in which the gage may rest on the bench or in the hand.

The DuBo gage head is a thin disk section of a sphere. The spherical gaging surface makes contact with the bore walls only at the point of bore gaging. Two chamfered sections, diametrically opposed on each member make it possible by slightly tilting the handle, to enter the gage into bores without force or risk of marring work pieces. The DuBo can be used to check deep bores, as the handle need be tilted only slightly when applying the gage and does not touch the bore walls. The design of the DuBo gaging members also permits accurate gaging almost to the bottom of blind bores. The chamfer edge serves an additional function in tending to wipe away foreign material from the gaging area.

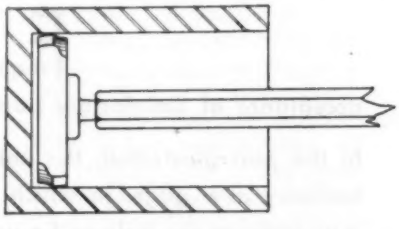
In use, only a small portion of the gaging surface makes contact with the surface of the bore walls. This focuses the gaging contact to a very



Face of the gage is relieved to allow full clearance when tilted. The gaging surface is spherically ground and limited to a small area of the full sphere

small area. As the DuBo gage may be introduced into bores smaller than its diameter, it provides a means for checking out-of-roundness and taper when these conditions are on the minimum side of the tolerance or smaller than the go dimension. It is possible to check a back taper in a part to discover faults.

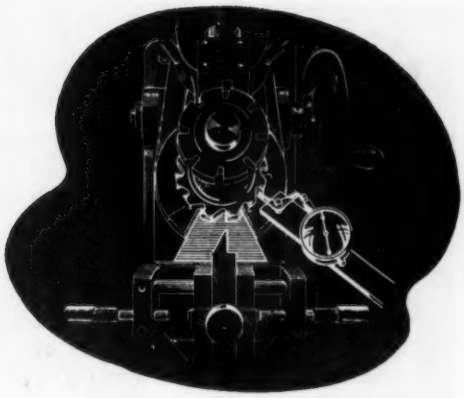
When checking a bore for lower limit, the go member is entered in the bore with the handle held lightly between the fingers and tilted slightly above the axis of the bore. The handle is then lowered without pres-

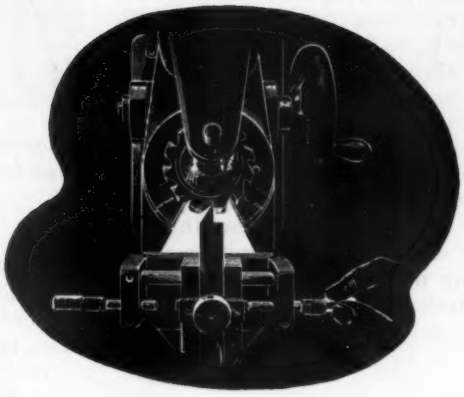


Slight amount of tilt required for clearance permits full entry into blind holes

sure or force. If the downward movement of the handle is arrested, it indicates that the bore is undersize at that point. If the handle drops freely below the axis of the bore, it shows that the bore is larger than the lower limit. The same method is used in checking for the upper limit, using the not go member. The gage is entered in the same way. The arresting or dropping of the handle indicates whether the bore is within or exceeds the gage dimension.

The thickness of both members of a double end DuBo is the same, giving an even balance that adds to ease of handling. Gage members are of highly lapped, special alloy steel.





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With the DETROIT combined hook and spacing checker you can check both cutter hook and flute spacing, at a glance. Hook is checked optically, spacing by a *built-in* indicator.

No surface plates needed
No separate dial indicators
No separate height gages

As near foolproof as a precision checking device can be made. Remarkably easy and quick to operate. Checks both shell and shank type cutters.

For complete description, ask for Bulletin HC-43

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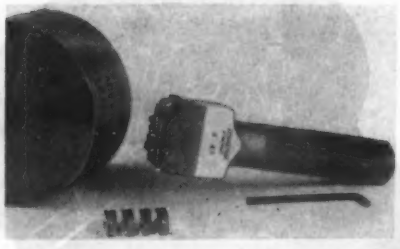


Tapered character blocks are locked in holder to form arc on face of stamp for peripheral marking

Special Stamps and Holder Mark Round Parts on Periphery

A character holder for marking parts on the periphery of solid round stock has been designed by New Method Steel Stamps, 147 Jos. Campau, Detroit 7, Mich. Interchangeable steel type is held in place by two setscrews and tapered in such fashion that when assembled in the type retaining mortise with wedges, a predetermined radius is automatically formed by the marking surfaces of the stamps. The handle of the holder is knurled for safe operation and tempered for long service under severe conditions.

Formed milling edges of Micro-King tool improve cutting action

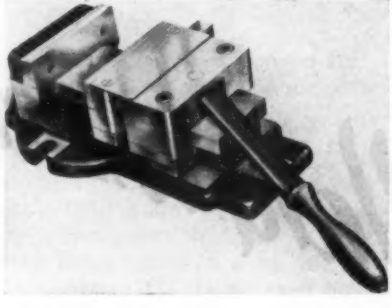
Holes in Difficult Materials Cut by Milling Action of Tool

Materials difficult to drill by conventional methods because of brittleness or low notch resistance that induces chipping or tearing are more easily drilled by the Micro-King mill-drill manufactured by Steel Tools, 2307 Prospect Ave., Cleveland 15, Ohio. The cutting edges of the tool are not ground to drill form but are shaped to provide a milling action in the material. The formed edges are arranged to cut the center and edge of the hole in advance of the material between them. This eliminates the side pressures evident with the tapered lead of the usual drill and assures a clean breakthrough. The fluted sides are arranged to mill the sides of the hole and prevent sticking as the tool enters the material.

Wedge-lock Production Vise Decreases Work Set-Up Time

The Universal Engineering Co., Frankenmuth, Mich., announces the manufacture of a fast-operating production vise. It is claimed that this vise, operating on the wedge-lock principle, reduces work change time on milling machine and drill press work as much as 80 percent.

A 15 deg. pull on the locking lever clamps work in the vise and a second pull of 7 deg. firmly locks the piece, ready for production. Pressure is applied to the adjustable jaw through taper wedges. Hammering or other forcing methods are not necessary. Interlocking teeth on the bottoms of slide and gib keep the adjustable jaw in place even under heavy cuts and vibration. In production work, the operator can load with one hand and manipulate the vise with the other. By loosening two screws he can adjust the vise to lock pieces of varying size. The splined roller contact of the sliding jaw permits exact adjustment for any size piece. Taper locking wedges and vise jaws are made of hardened and ground steel. Triple-locking contacts keep vise jaws absolutely parallel, thereby evenly distributing applied force to eliminate possible displacement or loosening of jaws. Made in three sizes, with 4, 5, and 6 in. jaw width.



Roller lock is adjusted by setscrews for quick changes of jaw opening

Insulated Electrode Holder Sheathed in Aluminum Armor

An armor-clad (screw type), fully insulated electrode holder has been announced by the General Electric Co., Schenectady, N. Y. Designed from the operator's viewpoint, the holder is recommended for use wherever durability, maximum safety and minimum operator fatigue are desired. The head is completely inclosed in a sheath of aluminum armor. This armor protects the insulation, resists weld spatter, and eliminates the possibility of accidental contact with the welding circuit. Thus, the holder remains clean while in use and lasts longer than insulated holders without armor cladding.

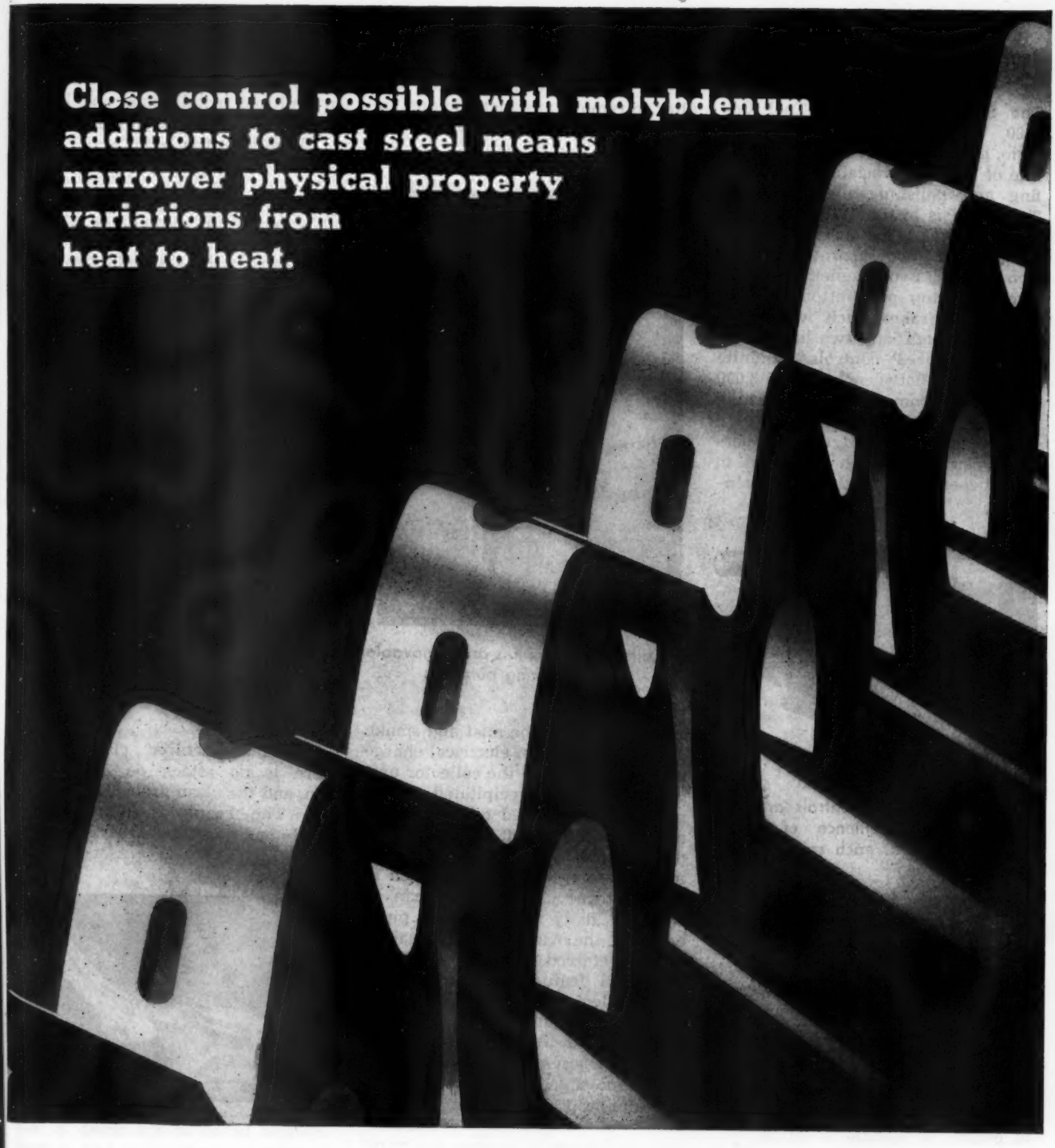
Aluminum armor protects insulation from spatter and short circuits

A slight twist of the hand tightens or releases the electrode. While in use, the holder firmly grips the electrode at the proper angle and good current contact is maintained. This keeps the holder cool, tends to prevent overheating of the electrode, and maintains a uniform melting rate down to a stub end. The threads of the push-up rod do not carry current. A soldered cable connection also helps the holder to remain cool. The width of the electrode slot limits the size of the electrode which can be inserted to ¼ in. max. dia., thus preventing overloading.

Hard Surfacing Electrodes Added to A-C Welding Rods

A-C Nickel Manganese, A-C Mo Mang Manganese and X2 and X3 electrodes are additions to the line of arc welding electrodes produced by Allis-Chalmers Mfg. Co., 22 Callos St., Milwaukee, Wis. The A-C Nickel Manganese and the A-C Mo Mang Manganese have application in the mining, cement, and railroad industries for repair and building of worn equipment. Characteristics of the weld deposit allow it to work-harden to 550 Brinell.

Hard-surfacing electrodes X2 and X3 are used to protect parts subject to extensive wear; X2 for severe abrasion and mild impact, and X3 for severe impact and mild abrasion. A-C Nickel Manganese and A-C Mo Mang Manganese are available in assorted sizes, both bare and coated, the coating being a combination suitable for both a.c. and d.c. welders. The X2 and X3 electrodes are available in assorted sizes with combination coating only.


Close control possible with molybdenum additions to cast steel means narrower physical property variations from heat to heat.

CLIMAX FURNISHES AUTHORITATIVE ENGINEERING DATA ON MOLYBDENUM APPLICATIONS.

ARMY E NAVY

MOLYBDIC OXIDE, BRIQUETTED OR CANNED • FERROMOLYBDENUM • "CALCIUM MOLYBDATE"

Climax Molybdenum Company

500 Fifth Avenue · New York City

MOLY

Dual Spindle Speed Polisher Provided with Dual Controls

The Standard Electrical Tool Co., 2480 W. Sixth St., Cincinnati 4, Ohio, announces an addition to their line of infinitely variable speed buffing and polishing machines. The Type R2V is available in 5 hp. and 7½ hp. sizes. This machine is arranged with two separate spindles, two motors, two magnetic starters, two start-stop pushbutton stations, two hand brakes, each with coincidental switch, and two handwheel indicator speed controls. Infinite speed range between 1,500 and 3,000 r.p.m. is accomplished by turning the handwheel.

Each spindle is individually operated, permitting each workman to be independent of others. Convenient spindle speed change permits polishing, coloring or buffing with the exact spindle speed required for each operation and, as wheels wear, the speed may be increased to maintain the desired peripheral speed. The dimension from the side of the base to the inside of the wheel is 11 in. but is available to order in 7½ or 7 in. measurement. Length of spindle is 78 in. Height to center of spindle is 38 in.

Speed and clutch controls are located for convenience of each operator at each spindle

Air Clarifier Removes Oil Mist By Electrostatic Precipitation

Introduced by the American Air Filter Co., 215 Central Ave., Louisville 8, Ky., into its electronic line of air filtration equipment, is the Electro-Mist, a self-contained electrostatic precipitator designed either to collect oil mist from high-speed cutting tools or welding fumes in light concentrations.

An axial flow fan mounted on top of the unit draws air from the operation which is hooded through piping or flexible tubing into the base of the unit. In its application to cutting operations, the mist-laden air first passes through a permanent unit filter to remove any metallic dust or large drops of oil, then enters the ionizer in which the mist and smoke particles receive an electrical charge before passing into the collector unit where they are precipitated on the plates. The collected oil mist accumulates and drips off the lower edge of the plates, through the filter and into a reservoir below. As much as two or three gallons of oil can be salvaged daily and may be piped back into the machine tool or drained off as preferred.

Collector assemblies are removable for cleaning purposes

Several features of the Electro-Mist collector are claimed to improve performance and simplify maintenance. A removable panel gives full access to all parts which are removable without tools. The operator is protected from any possibility of electrical shock since turning the latches to remove this panel shuts off the current to the power pack and all charged parts are short-circuited to remove any residual static charge. The filter and ionizing units slide out of the casing and the collector unit tilts forward, permitting the removal of the collector plate assemblies for washing or inspection at any location convenient to water and sewer connections. The 7-in. dia. intake may be turned to enter from any side of the casing, and the floor support, which provides space to drain the oil pan, may be omitted with overhead or wall mounting.

The Electro-Mist is made in one size—28¾ × 20¾ × 70 in. high. The power pack operates from nominal 115-volt, 60-cycle, single-phase line. On multiple installations one large power pack will handle as many as ten Electro-Mist collectors.

Chemical Cleaner for Filters Is Non-inflammable, Odorless

A process for the chemical cleaning of all types of air filters, including air conditioning, engine, marine and aircraft filters has been developed in the laboratories of Turco Products, 6135 So. Central Ave., Los Angeles 1, Calif.

This process eliminates the necessity of using distillate and other materials which may have an offensive odor or be a fire hazard. It also shortens the time required for the complete operation. With the Turco process, the filter is removed and immersed for six minutes in a tank of cold Turco Aktiv solution, four ounces to a gallon of water. The filter is then removed from the tank and given a cold water hosing to flush away dirt and grease; dried in a stream of compressed air and dipped into the manufacturer's specified oil.

The manufacturer claims that there is no attack on galvanized iron, and the clean filter is left odorless. The required equipment is simple and no skilled labor is necessary.

Plunger action of the clamp is reversible by moving one bolt in the handle to the second pivot hole

Dual Purpose Fixture Clamp Can Have Push or Pull Action

A push-pull fixture clamp with a plunger rod travel of 1½ in. is manufactured by the Detroit Stamping Co., 343 Midland Ave., Detroit 3, Mich. The De-Sta-Co model 610 can be converted from push to pull plunger action by relocating one handle bolt. Weight is 1½ lb. and overall length extended is 6¾ in. Plunger rod is tapped for a ⅜-16 bolt end.

God bless you, our fighting men, for the Victory!

Victory, born of courage and sacrifice by every member of our armed forces. Backed by the toil of millions of loyal men and women, you have spearheaded that surge of righteous power no enemy could long withstand.

And to those among you who paid for victory with blood and pain and life, our humble and undying gratitude — and our firm resolve that you shall not have suffered in vain.

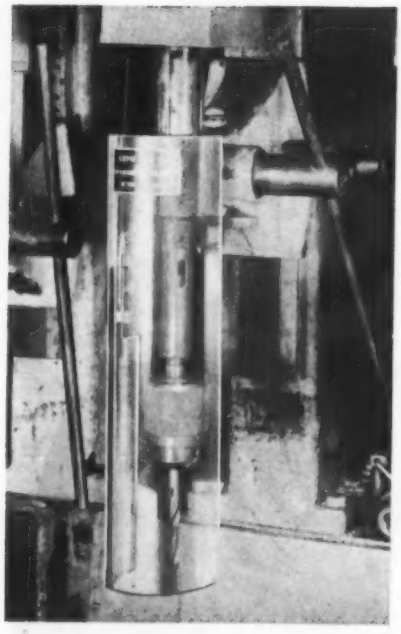
There are still bitter tasks remaining. You will face them as bravely as ever — and may God speed your triumphant return.

NEW DEPARTURE

Division of General Motors

MAKERS OF NEW DEPARTURE BALL BEARINGS

3302



Kleervue guards do not interfere with operation and can be installed on most machines

Transparent Guards Protect Without Obstructing View

Transparent guards for the protection of operators against chips, sparks and splashing liquids are manufactured by the Wright-Austin Co., 337 W. Woodbridge, Detroit 26, Mich.

The material used in the Kleervue guard is a heavy gage resilient plastic that is sawn, drilled or molded by the manufacturer to contours necessary to suit any machine.

TRADE PUBLICATIONS

Abrasives—Form No. 625 shows uses and describes the advantages of abrasive coated with Durabond which resists heat and gives rigid support to the cutting grains. Behr-Manning Corp., Division of Norton Co., Troy, N. Y.

Broaches — Leaflet describes performance of "Naloy" steel for broaches and illustrates several uses of broaches. National Broach & Machine Co., 5600 St. Jean, Detroit, Mich.

Corrosion — "Digest of Corrosion Preventive Specifications" lists a brief description of the principal government corrosion preventive specifications and approved products for each. E. F. Houghton & Co., 303 W. Lehigh Ave., Philadelphia 33, Pa.

Cleaners — Folder covers cleaning, derusting, phosphorizing, soldering and maintenance processes. For shop superintendents, factory manager, chemist, metallurgist or process engineer. Describes processes for the use of phosphoric acid cleaners, alkali power wash, still tank cleaners, maintenance cleaners, soldering fluxes, spray booth compounds and enamel or paint removers. Klein Chemical Works, 1500-1518 Woodbridge, Detroit 7, Mich.

Dies—Leaflet discusses Algoma templet dies. Algoma Products, Detroit 12, Mich.

Drills — Handy pocket-size card shows the diameter for each size of number or letter size drill. Engineering Department, Manufacturers Screw Products, 222 W. Hubbard St., Chicago 10, Ill.

Filing System — Leaflet A-694 describes card system for control by departments, operations, scheduling and dispatching. The McCaskey Register Co., Alliance, Ohio.

Heating — Bulletin B6372 explains the application of electronic heaters for both induction heating of metals and dielectric heating of non-metallic materials. Automatic timing for each operation assures uniform quality, with timing predetermined by test. Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.

Instrument—Publication No. G-419-1 describes a method for checking the straightness of V-ways of grinding machine tables of long lengths by the use of a microscope which measures the variation from a tightly stretched wire by means of an accurately graduated scale across the optical field. Cincinnati Grinders Inc., Cincinnati 9, Ohio.

Metal—Bulletin 66 "The Machining of Ampco Metal" is based on practical experience in machining Ampco metal and aluminum-bronze alloys. Diagrams, photographs, tables of speeds and feeds give information about the working of these metals. Ampco Metal, Inc., 1745 S. 38th St., Milwaukee 4, Wis.

Milling Machine — Publication M-1382, "Milling Machine Attachments," shows photographs of applications. Forty-one types of attachments are shown. Cincinnati Milling Machine Co., Cincinnati 9, Ohio.

Optics—"Seeing It Through" gives the history and background of the company, shows numerous pictures of products and practical applications of various optical instruments. Bausch & Lomb Optical Co. Rochester, N. Y.

Painting—Leaflet illustrates and describes the process of the electrostatic process spraying and detearing paint to metallic and non-metallic objects calling attention to the savings in material, labor and improvement in quality. Harper J. Ransburg Co., 1200 Barth Ave., Indianapolis 7, Ind.

Presses—Bulletin 550-A illustrates and describes spring-shop equipment for railroads; hydraulic presses for spring stripping, spring forming and spring testing operations: complete details are supplied for the machines. Bulletin 640-A illustrates and describes semi-automatic compression molding presses; complete specifications for many sizes of presses of two types. Watson-Stillman Co., Roselle, N. J.

Rectifier—Leaflet describes "Rectoplater" for transforming high voltage current into high amperes at low voltage electroplating purposes. The Udylite Corp., Detroit 11, Mich.

Rubber—Bulletin BU-23 gives load ratings, formulas, and dimensions of Vibraflex engine mountings of capacities from 20 to 600 lb. load. Bushings, Inc., 3442 W. Eleven Mile Rd., Berkley, Mich.

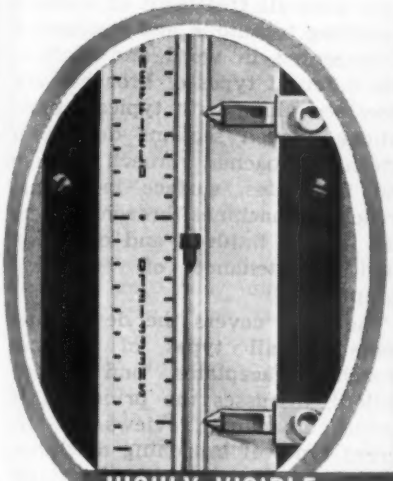
Toolbits — Folder of double-drawn high-speed toolholder bits of different analyses for various kinds of metal cutting. Sizes, weights and prices are listed. An explanation of the uses of each type of steel is given. The Carpenter Steel Co., Reading, Pa.

Tools — Catalog No. FE-121 gives prices of ten styles of general-purpose tools showing additional sizes recently placed in the markets included in straight turning, square nose, offset turning and boring tools. Firth-Sterling Steel Co., McKeesport, Pa.

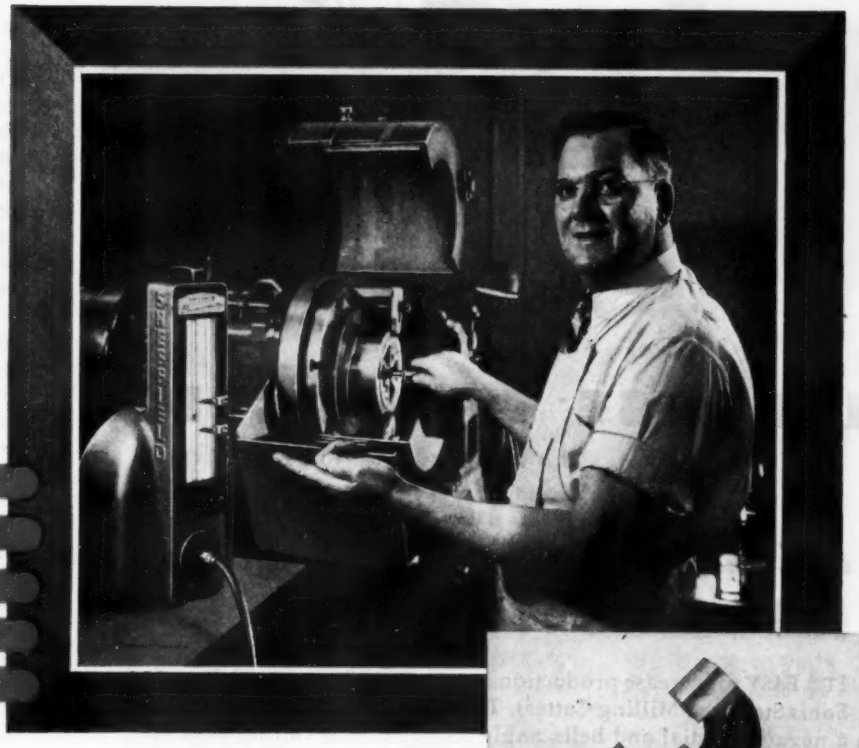
Welding—101 Welding Ideas, Bulletin 405, illustrates uses of welding for repair and reclamation. The Lincoln Electric Co., Cleveland 1, Ohio.

Wheels—Book illustrates and dimensions numerous sizes of steel wheels for rubber fired equipment. Electric Wheel Co., Quincy, Ill.

"THE *Float shows me* WHERE I AM!"



HIGHLY VISIBLE
INSTANTANEOUS
POSITIVE
EASIEST TO READ
NO PARALAX



"There's no guesswork about my job—and darned little scrap! I check every piece, starting with the first, right at the machine—and fast, too! The float tells me where I am—whether or not I am doing a good job and whether the machine and the tools are working okay. If something goes wrong, the float tells me, and adjustments are made right away before any amount of scrap is run."

Sheffield Precisionaires are helping thousands of machine operators to do "tough" jobs without realizing they're tough. High amplification combined with an easy-to-see float that "shows where you are" greatly simplifies the job. Scrap, rework and lost time are substantially reduced—production and assembly are increased in quantity and in quality.

"Chek with Sheffield" as to whether the use of Precisionaires at the machine will make your tough jobs easier.

AIRSNAP
FOR EXTERNAL DIMENSIONS

AIR SPINDLE
FOR INTERNAL DIMENSIONS

May we send engineering data . . . and have our representative actually demonstrate the PRECISIONAIRE to you?

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Dayton 1, Ohio, U.S.A.

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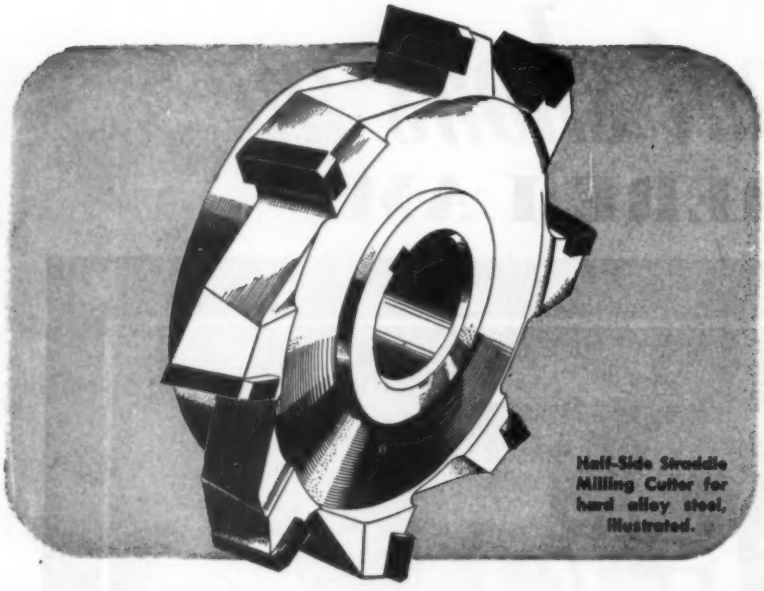

INCREASE PRODUCTION

as many as

10 TIMES

with these new standard carbide tipped

MILLING CUTTERS

IT'S EASY to increase production as many as 10 times with Wendt-Sonis Standard Milling Cutters. These new milling cutters employ a negative radial and helix angle feature on the cutting edge for milling steel; positive angle for milling non-ferrous materials.

Distinctive Advantages of W-S Milling Cutters

INCREASED SURFACE FEED—Machines hard alloy steel up to 750 surface feet per minute; non-ferrous materials up to 3400 surface feet per minute.

PREVENTS VIBRATION—The built-in heavy lug fly-wheel prevents vibration, adds strength to cutters; lengthens life of tool between sharpenings.

ESPECIALLY DESIGNED—for carbide cutting—not just a HSS design with carbide tips. Recommended for milling all types of material.

EASILY RESHARPENED—on any universal tool and cutter grinder.

Carbide Tipped Tools are a specialty with us. We make them exclusively. Our experience, research, development and improvements are your assurance of complete satisfaction when you use W-S Carbide Tipped Tools. Refer to "TOOLS" in your Classified Telephone Directory, for your local W-S Distributor, or write WENDT-SONIS COMPANY, HANNIBAL, MISSOURI. Branch Warehouse: LONG BEACH, CALIFORNIA.

Free!

New! CATALOG 144. Contains data and latest prices on W-S Standard Milling Cutters plus many other standardized carbide-tipped tools formerly classed as "special." WRITE TODAY for FREE copy.

WENDT SONIS

CARBIDE TIPPED CUTTING TOOLS

BORING TOOLS • CENTERS • COUNTERBORES • SPOTFACERS • CUT-OFF TOOLS • DRILLS • END MILLS • FLY CUTTERS • TOOL BITS • MILLING CUTTERS • REAMERS • ROLLER TURNING TOOLS • ROUTER BITS • SPECIAL TOOLS

NEW BOOKS

MANUAL OF BROACHING — *Published by the Detroit Broach Company, 20201 Sherwood Ave., Detroit 12, Mich. 83 pages. $1.50.*

An over-all treatment of modern broaching technique and equipment is presented in word and picture. The different types of broaches are described along with typical applications. Seven sections deal with internal broaches, broach pullers and faceplates, surface broaching, broaching machines, broach holders and inserts, fixtures, and operation and maintenance of broaching equipment.

The book covers the design and usage of all types of internal broaches, faceplates, and broach pullers; discusses the principles of surface broaching; reviews the different types of broaching machines, outlining their uses and advantages for particular types of work; and devotes considerable space to broach sharpening.

Tables give broach standards and should serve as useful reference for those engaged in such operations. Modern developments in broaching are explained in detail. Many applications involve wartime products, and these are described and illustrated. The book closes with a showing of form blanks for the ordering of internal or hole broaches, and external surface broaches.

SEEN and HEARD

By JOHN R. GODFREY

Minimizing Cost of Spoilage

IN A PERFECT SHOP with perfect management and perfect men there would be no spoilage. But I find none of that kind in my travels. So the next best thing is to reduce the cost as much as possible. Part of this can be done by design and part by the routing of the work through the shop. A case in mind is one of the components of a new device being built for the Navy. This part is a heavy forged flywheel or rotor having a series of rather small fins or blades cut in one side.

As the rotor is now made, cutting of the blades is the last operation, and an error in indexing ruins the whole rotor, which means a heavy loss. There are two ways of minimizing this chance at loss. One is to perform this indexed milling as

early as possible in the sequence of operations. The other and safer method is to make these fins as a separate unit and attach it to the rotor when completed. These fins can be made all in one piece on a ring base by precision casting and require little work to attach. Or they can be flashwelded from sheet steel and attached in the same way. Either method virtually eliminates spoilage from this source.

Paint for Machine Tools

DARK GREEN was a favorite color for machine tools when I was an apprentice. Just before New Years Day we used to clean up the machines and each man painted his own. Then came the time when the Pittsburgh Locomotive Works, managed by my old friend Don Wightman, painted all its machines white. In smoky Pittsburgh, this was a startling innovation, but it added much light to the shop. Next came the Bullock Electric Company, in Norwood, Ohio, who painted all its machines with aluminum paint. Incidentally this was probably the first shop in which every machine was direct motor driven; largely to advertise their motors.

Then the machine tool builders adopted a standard gray which, while not showing dirt, was probably too dark for best results. Now I'm finding shops with the main parts of the machines painted a lighter gray with a contrasting color for hand wheels, levers and other parts which control the operation of the machine. One pleasing combination had the body of the machines a rather light gray with a light yellow as the contrasting color. In some cases the light color is used where it will form a contrasting background for the work itself.

Acme Thread System Expanded To Include Centralizing Threads

BECAUSE OF aircraft requirements for special-purpose Acme threads, a war standard covering three classes of general-purpose threads and five classes of centralizing threads has been approved under American Standards Association procedure. Copies are available from the Association at 70 East 45 St., New York 17, at 50 cents each. The same information is also a part of the National Bureau of Standards Handbook H28 (1944) entitled, "Screw-Thread Standards for Federal Services," and available for 60 cents from the Su-

A CONVEYOR-COORDINATED PLANT that you can be proud of!

ARE you satisfied with your present production plant? Does material or goods in process flow smoothly with the least disorder, loss of time, waste of space or man-power?

If there is room for improvement, isn't it a matter of better coordination—better linking of all the steps involved from receiving — to shipping?

Whether your rate of manufacture is several hundreds a minute or one an hour, Standard builds conveying equipment to meet the situation.

The range and versatility of Standard Conveyor equipment are the result of nearly 40 years of close contact with inside-the-plant transportation — in plants large and small, making products as widely diverse as steel or cosmetics. The benefit of this experience is available to you, without obligations. The counsel of Standard Conveyor engineers is valuable in deciding on the right kind of conveying equipment to coordinate operations faster — for lower cost.

Write for comprehensive reference book—"Conveyors by Standard"—Catalog No. AM-65.

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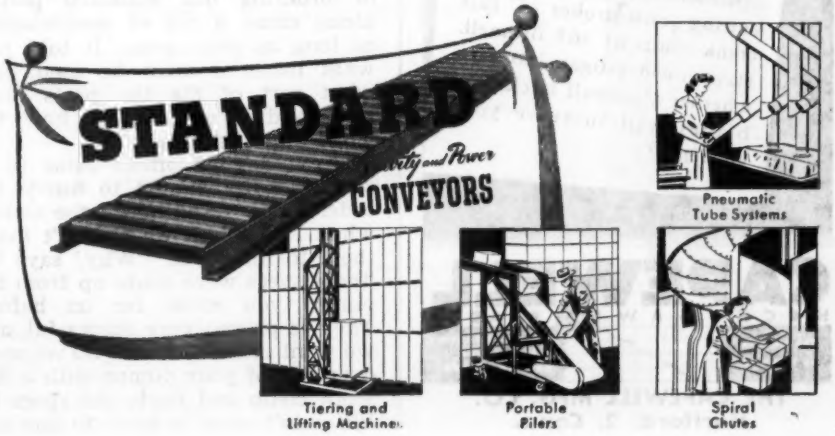

TECHNITE
Switched to Capewell
HACK SAW BLADES FOR CUTTING
Cast Crank Shafts
FOR HEAVY MARINE ENGINES
For greater efficiency...longer blade life with fewer shut-downs and more continuous operation . . . a Mid-Western manufacturer of marine engines shifted to Capewell's Technite hack saw blades. The operation consisted of wet-cutting at 60 strokes 14" cast crank shafts of 362 Brinnell. Have you investigated to learn whether Capewell hack saw blades will increase your efficiency?
CAPEWELL
HACK SAW BLADES
The trend is to TECHNITE.
the molybdenum high speed hack saw blade
THE CAPEWELL MFG. CO.
Hartford, 2, Conn.

perintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

The three classes of general purpose threads have clearances on all diameters for free movement and may be used in assemblies with the nut rigidly fixed and movement of the screw in a direction perpendicular to the axis limited by the screw bearing or bearings. The five classes of centralizing threads have a limited clearance at major diameter of screw and nut so that bearing at major diameter maintains approximate alignment of the thread axis and prevents wedging on the flanks of the thread. For any combination of the five classes of screws and nuts covered in this standard some end play or backlash will be obtained. This is unavoidable for interchangeable product.

This American War Standard will be reviewed through the regular procedure of the ASA when the war emergency has passed. It will then be decided whether the standard shall be approved as an American Standard (possibly in amended form) or whether it shall be withdrawn.

Specifications— And How They Grow

BY JOHN R. GODFREY

"GOVERNMENT SPECIFICATIONS," said Old Man Johnson, "date back to the days when most business was in the horse trading class, and too many suppliers seemed to feel that putting one over on the government was the height of smart business. Their ethics were about on a par with the Japs' attack on Pearl Harbor. But detailed specifications too often go off the wrong end and do more harm than good.

"Years ago I built some pumps for the Navy that turned out pretty well. They were our standard pumps which they bought as we made them. Some years later they wanted another batch. But instead of ordering our standard pumps along came a set of specifications as long as your arm. It told just what material must be used, just what sort of fits the parts must have and in some cases how the work must be done.

"Next day an officer came in to see me. He wanted to hurry the order along. And he hit the ceiling when I told him we couldn't make them to his specs. 'Why,' says he, 'those specs were made up from the pumps you made for us before. They've proved very successful, and we want more of them. So we went over one of your pumps with a fine tooth comb and made the specs fit. We didn't want to have to buy another make if their bid happened to be ten cents below yours. And now you say you can't make them. For Pete's sake why?'

"Glad our pumps worked out so well, Captain. But specs like that work both ways. Since we built those pumps we've learned a lot. We use different materials in some places. We find that some of our fits were closer than necessary. We've abandoned threads in some places and weld the parts together. So your inspector could reject our new pump—fact is he couldn't pass it, even though it's a lot better than the one you like so well.

"Making specs like that ties you to old machines. They were good in their day, but they block you from getting any new and better machines. So I think you've got entirely the wrong idea about specs. What do you care what material we use or how the parts fit, if the machines do what you want them to for as long as you feel they should be used?

"Specs on new designs are also a hindrance to any contractor. The average designer knows little about shop practices. He draws shapes that are difficult to machine when they could be made simple. He hears that 'any good shop can work to thousandths' and sticks those tolerances on everything. Someone tells him about Class 3 thread fits and he calls for them on grease fittings and parts that need not be accurate.

"He doesn't know that it may mean a lot of unnecessary work, broken taps if the material is hard, and it is entirely unnecessary in many cases. He specifies honing or grinding on clamping surfaces that would be better if not too smooth. He calls for needle or ball bearings in places where a plain bushing is equally good.

"What would I suggest? Can't take any old thing any maker wants to sell you? Of course not, Captain. I'm just as anxious as you are to have things made and get this war behind us as you are. But what you want, what we all want, is results. So why not specify the results you want, and then put it up to the contractors to get them? Suppose you tell me you need pumps that will handle so many gallons a minute with a given size motor and last for so long. In this case you'd simply specify pumps as good as those we built you before. Our later pumps will do a lot better. So you'd get a better pump, and we could go on with our regular production schedule. Specs made up from our old pumps are completely out of date.

"All this, Captain, brings us to another sore spot—inspection. It is tied up to your detailed specs and has a lot to do with delays, increased cost and general unpleasantness. But that's another story."

THE FILE FOR BRASS

WITH structure all its own, brass is a difficult metal to file. While softer and more malleable than steel, brass is tough and ductile. These characteristics demand file teeth that are sturdy, very sharp, and cut at an angle that prevents "grooving" and running the file off the work. Still more important, the file must not clog.

The Nicholson Special Purpose File for Brass is designed to meet both these requirements: The short upcut angle helps to keep the file "on course"; and the fine, long-angle overcut produces small scallops which break up the filings and enable the file to clear itself of chips.

The special combination of angles and tooth design not only eliminates clogging and chattering, but it also prevents the file from taking too deep a bite and leaves the surface gratifyingly smooth.

For fast, efficient results, and for keeping file in good cutting condition, workmen should be cautioned against the use of regular Flat (double cut) or Mill (single cut) files which have a tendency to fill up when working on brass.

"FILE FILOSOPHY," the interesting, illustrated 48-page book on file kinds, use and care, will prove helpful to foremen and production heads in instructing mechanics on the use of *The right file for the job. FREE.*

NICHOLSON FILE CO. • 29 ACORN STREET, PROVIDENCE 1, RHODE ISLAND
(In Canada, Port Hope, Ont.)

NICHOLSON FILES *FOR EVERY PURPOSE*

NICHOLSON U.S.A.

New! Just Perfected! A Brushing Tool that Cuts 4 Times Faster... Lasts 3 Times as Long!

OSBORN'S new Monitor brushing wheel No. 1409-S-22 provides industry with a production tool capable of *increasing production rates* substantially and ultimately *decreasing cost per unit.* It extends the application of fine wire brushes to work which previously, in many cases, had to be done by hand.

This new Monitor is the ideal tool for deburring aluminum, brass and other ductile metal parts—also for hardened and unhardened steel parts.

It attains and *retains* high-level, uniform cutting ability—for the life of the brush—qualities which make it an excellent performer on rubber parts or wherever there is resistance to the fill wire.

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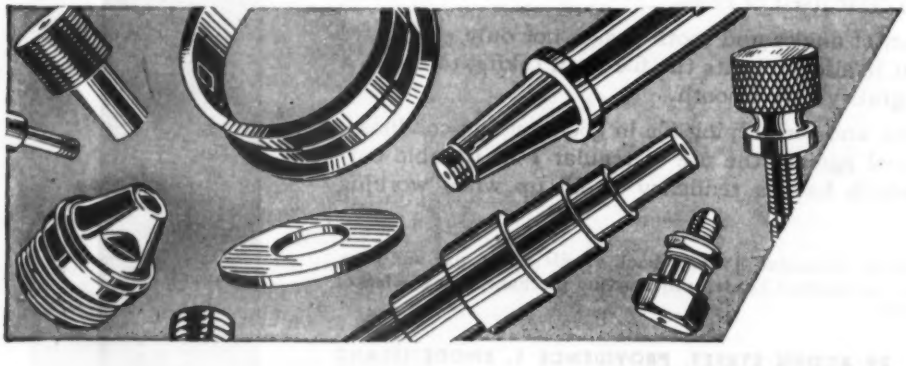

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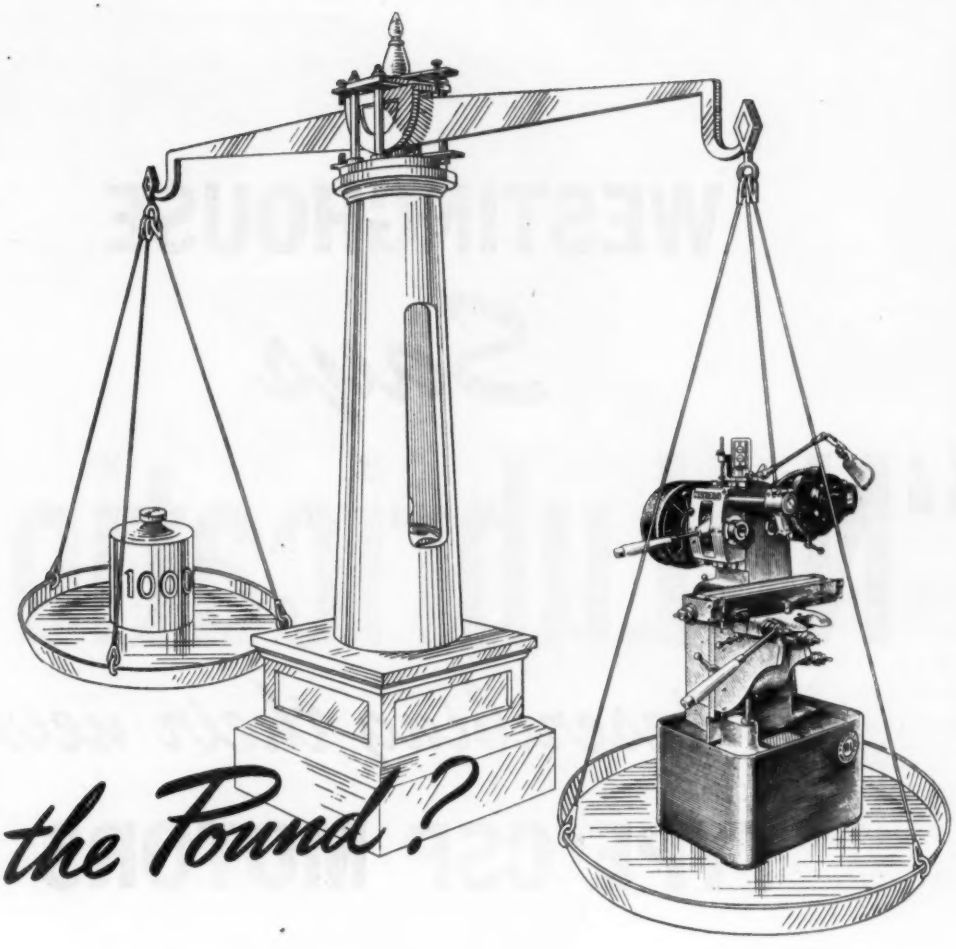

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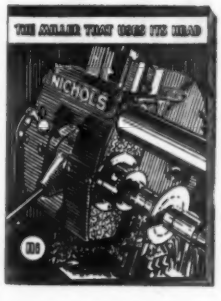

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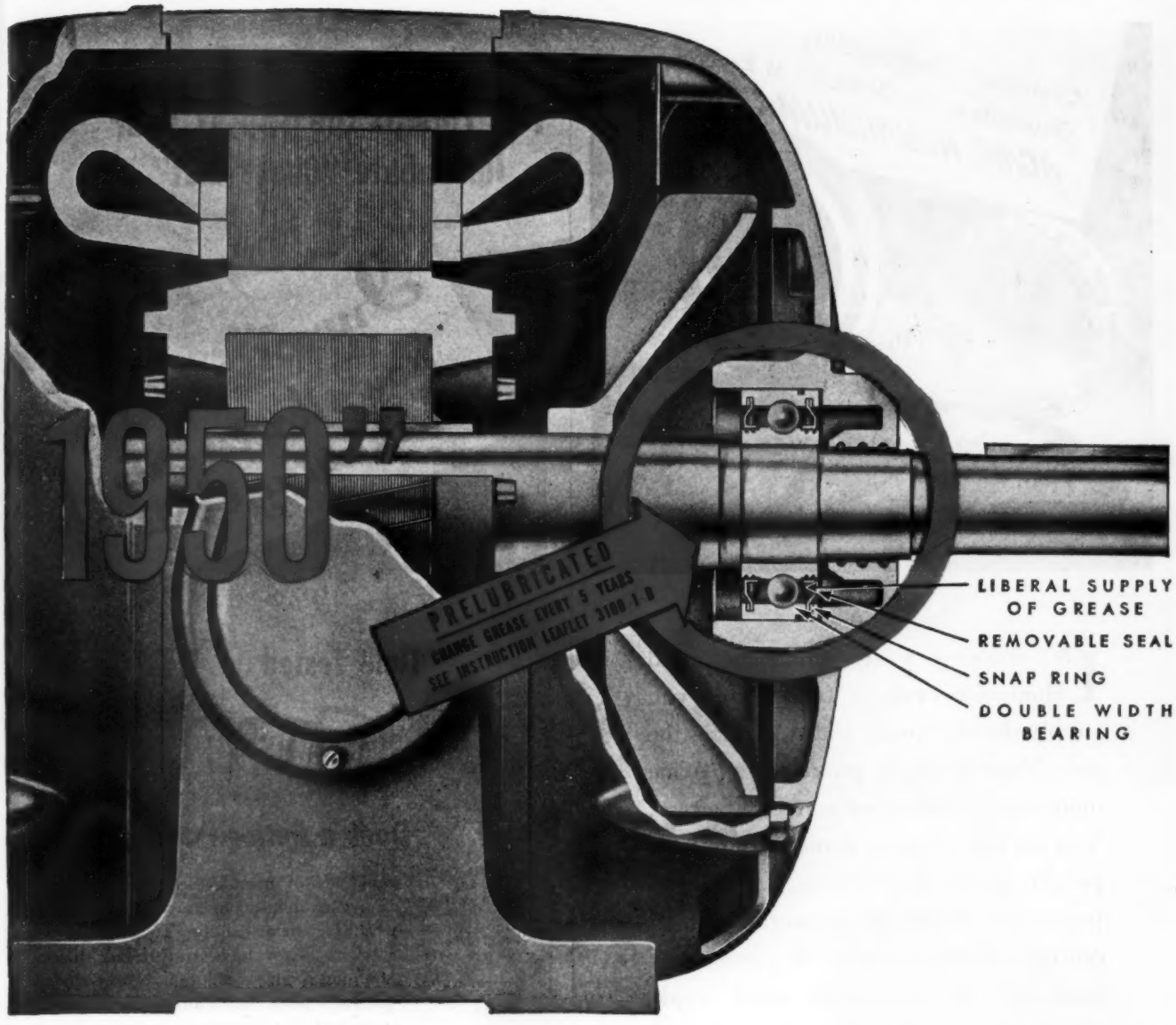

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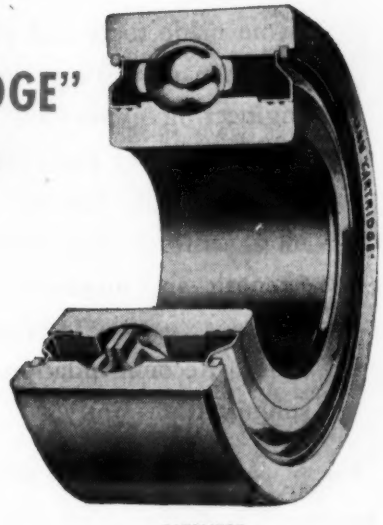

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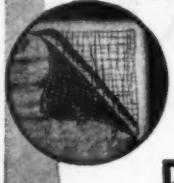

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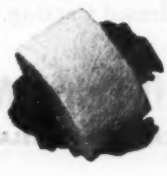

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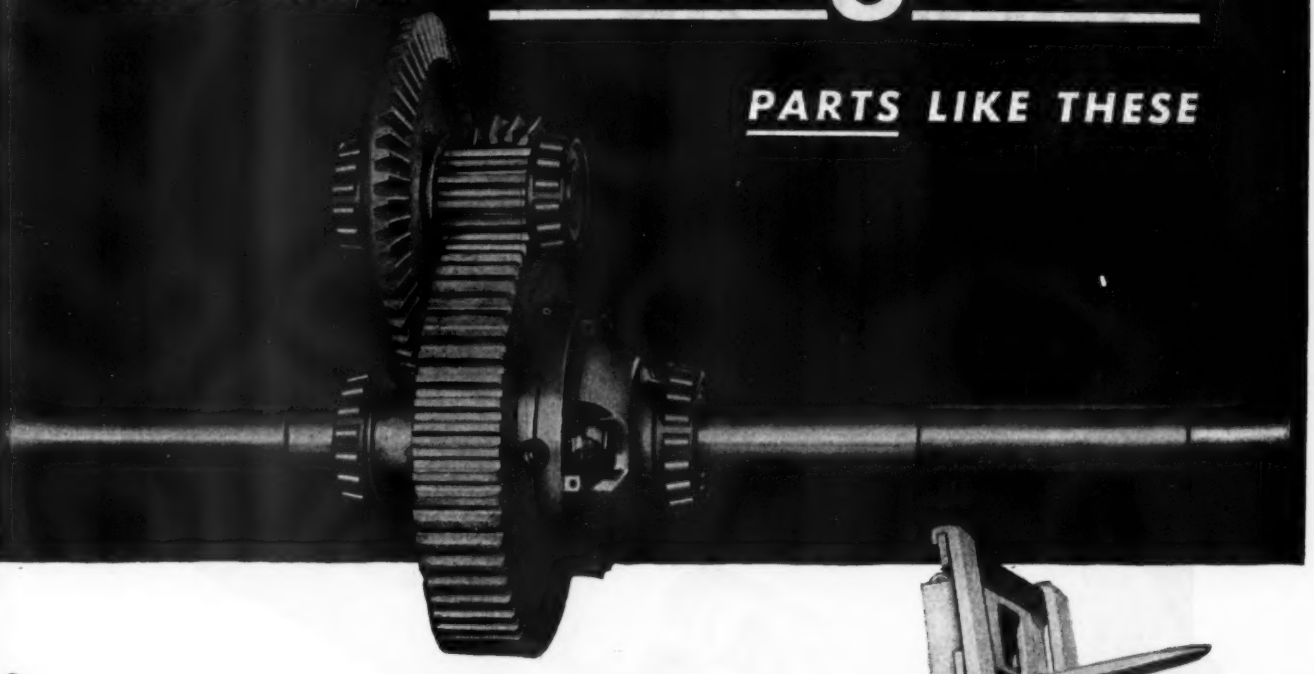

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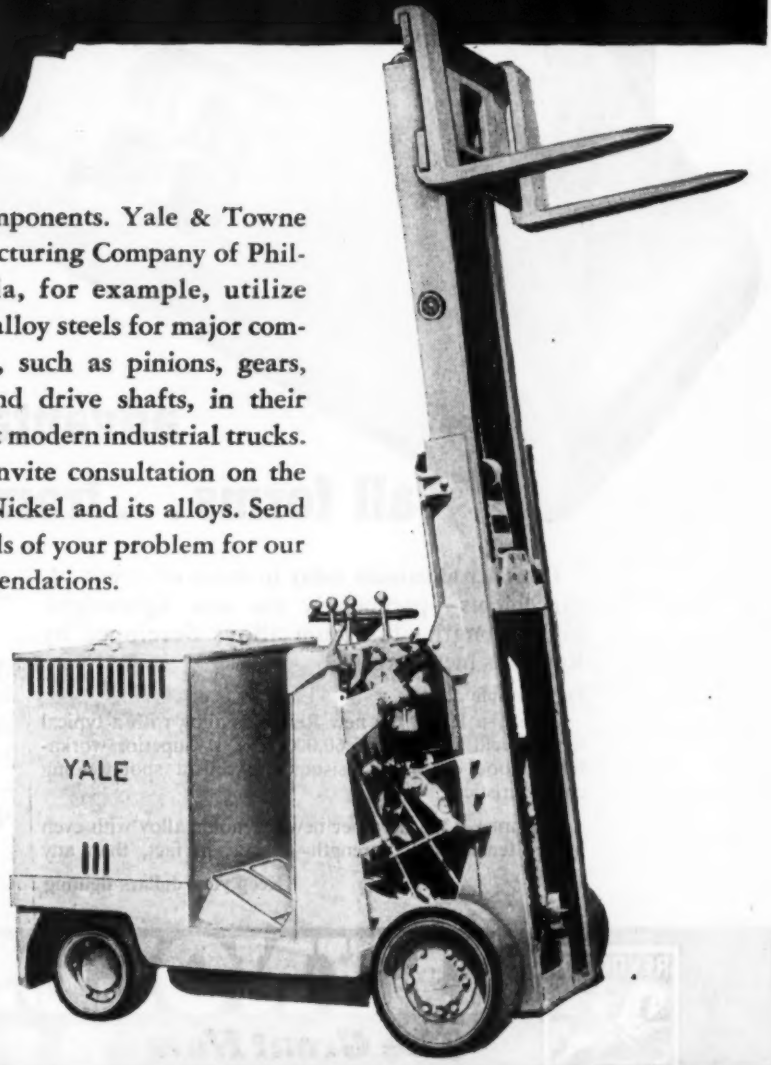

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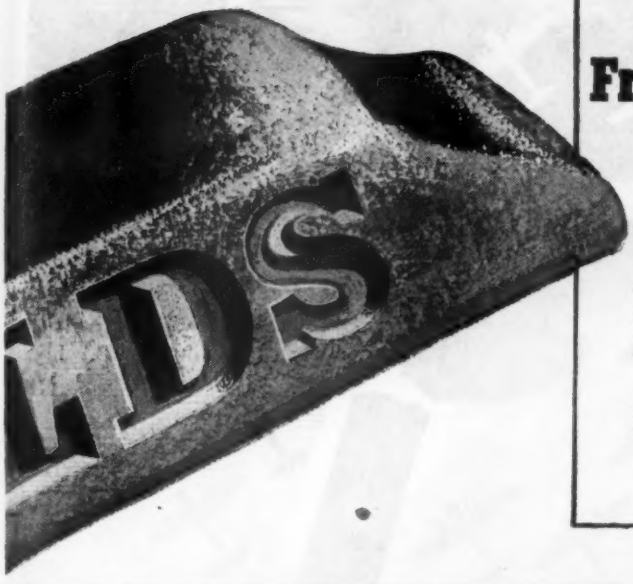

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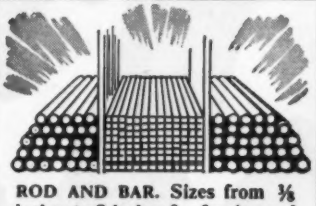
See the Reynolds catalog in Sweet's—or write for bulletins outlined in the paragraphs below.

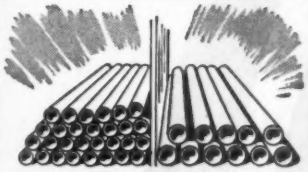
SHEET AND PLATE. Standard gauges, sizes, alloys. Special items. Bulletin 22-A gives specifications, ordering data, etc. 8 pp.

WIRE. Cross sections less than ⅛ inches. See Bulletin 31-A for specifications, ordering data, etc. 12 pp.



ROD AND BAR. Sizes from ⅛ inches to 8 inches for forging and machining. Bulletin 31-A gives complete information.

SHAPES. Rolled and extruded sections to fulfill individual needs. See Bulletin 35-A for full information. 8 pp.



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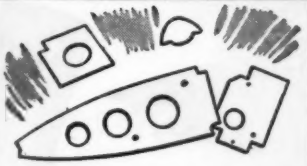
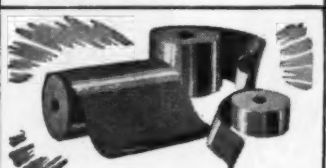
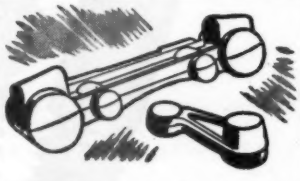


PARTS. Fabrication at aluminum source saves manpower, plant space, scrap and transportation. Ask for further information.



FOIL. For years the largest producer of light-gauge aluminum for packaging, technical and insulation purposes. Bulletin on request.

POWDERS AND PASTES. For aluminum coatings. Bulletin 21-A gives forms, applications, evaluations. 20 pp.



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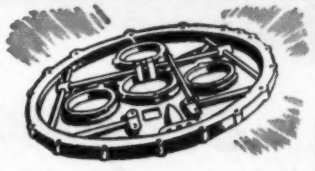

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FREE! Many of the bulletins mentioned above belong in your files for quick reference. Please use coupon in requesting.

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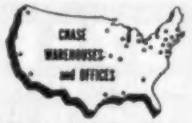

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How Stainless Steel is Machined at Roebling's

Correct Control Brings Results in Quantity Production of Aircraft Cable Fittings—Tolerances of .0005″ Maintained—Importance of Power, Speed, Feed, Tool Angles, Coolants

A Report on the Details of Operations in the Trenton, N. J. plant of John A. Roebling's Sons Company

The machining of stainless steel is not difficult, but different, as compared to ordinary screw stock. The main difference is that you cannot be careless with stainless. Everything along the stainless production line must be kept under exact control. This sums up the experiences of Ray Brodowski, Foreman of Dept. 26, John A. Roebling's Sons Company, Trenton, New Jersey.

The job must be done with unusual accuracy. All the strength that can be had must be crowded into very thin cross sections with widely differing dimensions. This calls for fine machining with a capital "F"; the job would be tough to handle no matter what the material.

The finished parts must be swaged onto steel cables. This requires the selenium grade of Rustless 18-8 FM, Type 303, since the grades containing other free machining agents have been found unsuited for this severe operation.

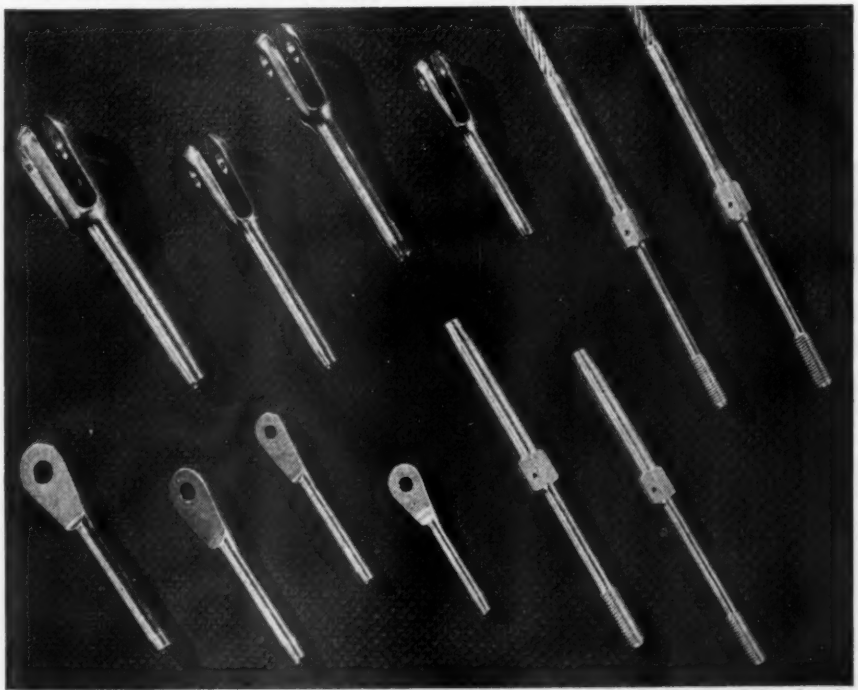
In the face of these problems, Roebling's is making these parts quite successfully. A few simple methods are followed; methods which would make for accuracy on any material but are especially applicable to stainless.

The first essential is absolutely uniform steel; steel that always behaves properly in the machines. A large proportion of the stainless used by Roebling's for this job comes from the specialist in stainless steels, the Rustless Iron and Steel Corporation.

An overall control principle which applies alike to every operation is: "Do not be gentle with stainless". Whether they are severing the metal by cutting or compacting it by swaging, Roebling's men always apply plenty of power.

The reason for this is that this grade of stainless tends to work harden ahead of the tool. Each successive "bite" therefore must get beneath the work hardening left by its predecessor. Cutting tools should have heavy feeds; otherwise too much of the chip area will be of work hardened steel and the tools will burn up. Swaging tools must have force enough so they are compacting metal beneath the surface layer which has been hardened by previous impacts.

After the terminals are swaged to steel cables, the entire assembly is proof tested to 60% of its minimum breaking strength. They must stand this test with extremely limited elongation. Variations in the strengths of the stainless steel fittings, then, would mean scrapping not only of these completely finished parts but also (in many cases) of the cables as well. In fact, the high and uniform strength of stainless coupled with excellent ductility is one of the principal reasons for using it on these cable ends.



Several million fittings of assorted types have been machined from stainless steel Type 303 for aircraft control cable terminals by various manufacturers. Corrosion resistance, high strength, ductility for cold swaging, combined with machinability, are the major reasons for the use of this type of stainless.

On the Automatics

The sizes of stainless steel bar stock used as raw materials, run from 13/16″ down to 7/32″ round, and 3/16″ to 3/8″ hex.

First operations usually are performed on automatic screw machines, with shank diameters machined to tolerances of plus .000″ minus .003″, lengths of cuts held to plus .000″ minus .020″.

The rake and clearance angles of tools are highly important, since the first rule of stainless machining is to keep all tools perfectly ground and perfectly set.

Roebling's has found the recommended tool angles on page 7 of the Rustless book, *"Shop Notes on the Machining of Stainless Steel"* quite satisfactory. (That book, which was one of the most understandable and useful ones in the shop, has just been replaced by a new and much more comprehensive Rustless booklet, *"Machining Stainless Steels."*)

No chip breaker is used unless the chips produced without one are bothersome or damaging to machine operation. The reason is, the finish is smoother if the chips are not broken. In general, no chip breaker is needed for any cut of less than 1/64″ depth, but from 1/64″ to the deepest cut of .225″ the chips must be broken.

Turning feeds range from .0015″ to .0047″, with speeds from 70 to 94 surface feet a minute (SFM). The heavier the feed, the less the troubles from work hardening. But if tools show signs of over-heating, the chip pressures must be reduced or other factors modified. Usually the speed is reduced and the feed kept constant.

(ADVERTISEMENT)

Reducing the feed is the surest way to get into work hardening troubles, and these will burn up the tools in short order.

Drilling is one of the difficult operations. The holes, after centerless grinding the shank, must be concentric and parallel with the O.D. to plus or minus .005". And those holes are small and deep.

Spot drilling and inside chamfering are performed at one position, then the hole is drilled to about ⅓ of its final depth at a second position. The final drilling is done on drill presses, a recommended practice which increases automatic screw machine output.

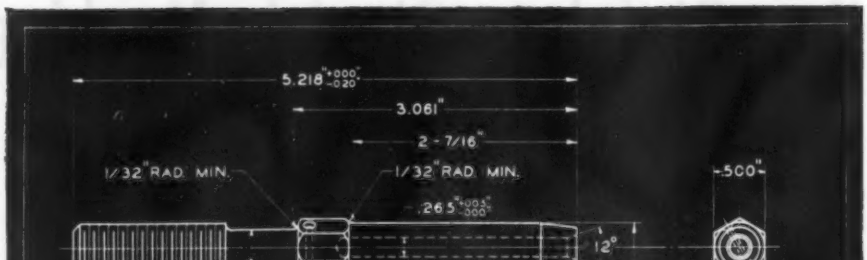
It is important that all drilling on the automatic be done at positions where very little side pressure is being exerted by other tools upon the stock. Such side pressure can make differences as great as .002" and even .003" in the concentricity of the hole.

Operators inspect every piece that comes from the automatics. At the slightest sign that a machine is "crowding the limits" or otherwise threatening to give trouble, the set up man is sent for. Continual inspection is one sure way to avoid trouble. Precision machining of stainless must be kept under complete control.

Centerless Grinding

Many of the precautions taken to insure dimensional accuracy and perfect finish would be as necessary with other steels as with stainless. Some of the centerless grinding precautions are among them.

Centerless grinding usually follows the automatic screw machine operations. The purposes of the grinding are (1) to remove all scratches and tool marks, and (2) accuracy, with sections which are to be threaded being held to plus or minus .0005". To make sure that the grinding gets below all tool marks and leaves a flawless finish, from .005" to .008" of stock is removed.



This terminal is machined from stainless steel, Type 303, at high-production rates. See accompanying text for details of machining operations.

It is important to keep all contaminants out of the grinding coolant. Therefore all work is cleaned and degreased before being taken to the grinder. Any straight cutting oil from the automatics carried to the grinder with the work would change the viscosity of the grinding coolant and might cause the entrainment of steel chips or of abrasive particles with consequent scratching of the work.

The coolant is mixed 20-1 with water, and a special paste is added to increase the lubricity.

Lubricity is needed to make sure that the work is not scratched by the work rest blades. For further protection against scratching, the blades are tipped with an aluminum bronze which is an excellent bearing material; it has very low coefficient of friction when lubricated by the coolant. This bronze has displaced harder and longer lived blade tip materials, with marked improvement in work finish. When badly worn it is restored by a simple welding operation.

The blades are carefully set to a 20° angle. This angle holds the work in position with minimum bearing pressure between work and blades, with consequent minimum scratching if any abrasive gets between the work and the bronze. And at the same time, it permits the coolant to flow off freely, with no surfaces which will entrap loose particles and keep them in position to scratch the work.

Grinding wheels must be dressed often enough to keep up the production rate of the machine and preserve perfect finish on the work. All the grinding must come up to shoulders which bear on one side of the wheel only. The first wheels used, refused to stand the stress of grinding against hex shoulders. Therefore a wheel was adopted which has a 3/16" hard side; the main body of the wheel being 80 N5BE (Norton Company) and the hard side 80 P5BE.

This wheel needs dressing only after every 200 pieces or so, as compared to 75 pieces for the old one. There is a worthwhile gain in daily output as well as in wheel life.

On the Drill Presses

Drilling of the deep holes present two problems: (1) to get the holes concentric and parallel with the O.D., and (2) to complete them to their full depth. Starting the holes accurately is best done on the automatics. But finishing them to full depths requires repeated raising of the drill points from the work and lowering them again, each such cycle being called a "dive". And this diving or pecking motion is most easily accomplished as a secondary operation on a drill press.

Roebling's has found that some holes should be drilled on manually controlled presses, while others can be done on the Leland Gifford Hydromatic Automatic Drill presses. The difference is in the size of the drill. Drills smaller than No. 17 need manual control.

The operator of the manual press must have a sensitive touch. Only by "feel" can he tell when to lift the drill for another dive. Furthermore, he must be careful to raise the drill as abruptly as possible so the drill point does not idle on the work and cause work hardening.

Automatic controls, by contrast, are

Machining terminals on the automatics

set at 3/16" per dive. They lift the drills quickly enough to prevent any troublesome amounts of work hardening.

Crankshaft drills were used originally, but it was found that the Hi-Spiral ones were equally rapid in action and could be re-ground much more quickly.

Grinding of the drill points is important. First of all, the grinding wheel must be diamond dressed to the highest possible accuracy so the point itself is fully accurate. After that, the drill point must be ground to a far more obtuse angle than is used for carbon steel. 140° is about right. (The standard angle is 118°.)

As in all stainless machining, Roebling's finds that it is better to cut down the SFM than the feed if drilling troubles are encountered. Feeds range from .002" to .004", SFM from 40 to 50. Chips should be heavy enough to work up the flutes readily. Light chips tend to get between the sides of the drill and the hole, causing rapid wear of drills as well as spoiled work.

Because of the high cutting temperatures at the drill points, soluble cutting oil has displaced the "straight" kind on this work. The soluble oil also tends to preserve the clearances on the drills longer, and to remove the chips better.

With such accurate control methods, Roebling's is doing some highly accurate drilling. One example is two .272 Dia. parallel holes drilled simultaneously only .024" apart in 13/16" stainless stock.

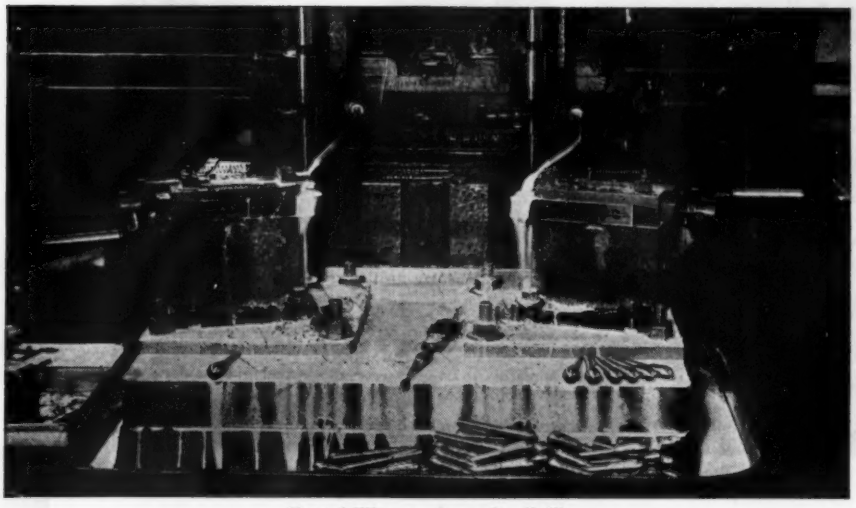
Thread Rolling

The thread rolling is the last major operation, and it is the one which is most easily spoiled by any variations in the stock. Roebling's, of course, cannot do anything more about the steel itself than to make sure that it comes from a steel plant which is rigid about living up to specifications. But Roebling's can—and does—be careful that the sections to be threaded are well within their plus or minus .0005" tolerances. This initial accuracy would be necessary with any metal to roll threads to a class 3 fit, but with a tough metal like stainless it also helps the rolling operation.

Thread rolling, like all other operations on stainless, requires plenty of force. Thus, even on these small parts the No. 20 Waterbury Farrel Machine is not heavy enough for some of the work and the No. 30 does much better.

Speeds must be controlled. A Reeves variable speed drive is attached to each thread rolling machine, and speeds are variable within a wide range. The larger the thread the faster can be the machine speed. Straight cutting oil is used as a die lubricant.

Inspection is close. Work specifications call for a number 3 fit, which means no taper, full size with proper lead and pitch. A comparator is within easy reach of each machine, and every tenth piece is checked by it.



Deep-drilling on the pecker Drills

General Working

Standard grade of high-speed tool steels are used, the only requirement being that the tool must be Rockwell C65 or harder. But this requirement must be observed; softer high-speed steels had only one-third the tool life of the C65 ones.

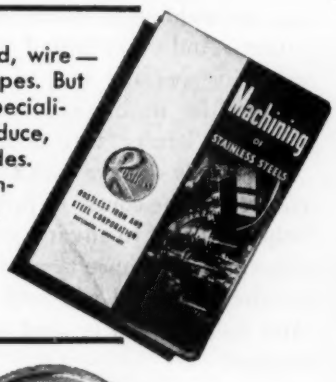
Cutting oil for every operation must be high in lubricity and have no tendency to gum or stick the working parts of machines. All new cutting oil is sterilized before being fed to the machines. Keeping the cutting oil clean and free of entrained metal particles is important. At least 50% of the oil used in the automatics is cleaned in a Barret oil reclaiming and cleaning system every day. Each machine is completely cleaned out at least once for every twenty days of continuous operation. The results include higher production rates, fewer spoiled parts, and almost no dermatitis among operators.

The cutting oil is fed at the maximum pressure which the machine pumps can deliver. It must be carefully guided so the full force of the stream strikes at the spots where the chips impinge upon the tools.

Methods like these keep the stainless production line flowing smoothly. They are helped by the fact that any carelessness quickly shows up in damaged work, and therefore the carelessness cannot be hidden. The machining of stainless steel, in short, is a job for the man who knows how to get his machines under control and keep them that way.

The End

Rustless produces stainless steels only, in bar, rod, wire—rounds, squares, hexagons, flats and special shapes. But we offer you much more than that. By intensive specialization we have learned not only how to produce, but how to select and fabricate the various grades. For example—our machining engineers have completely revised our popular booklet, "Shop Notes on the Machining of Stainless Steels." Copies of the new booklet, mentioned in this advertisement, will be sent free on application.



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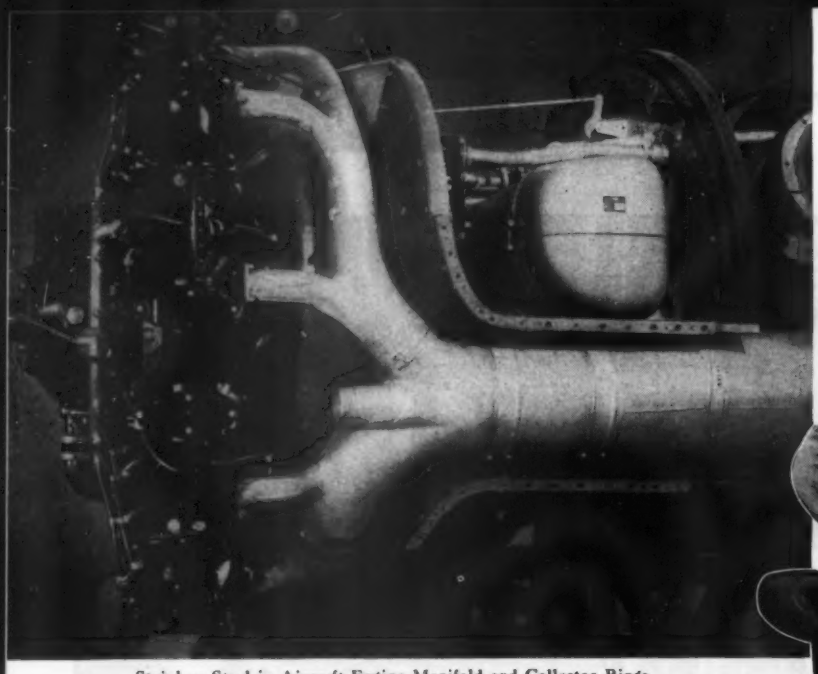
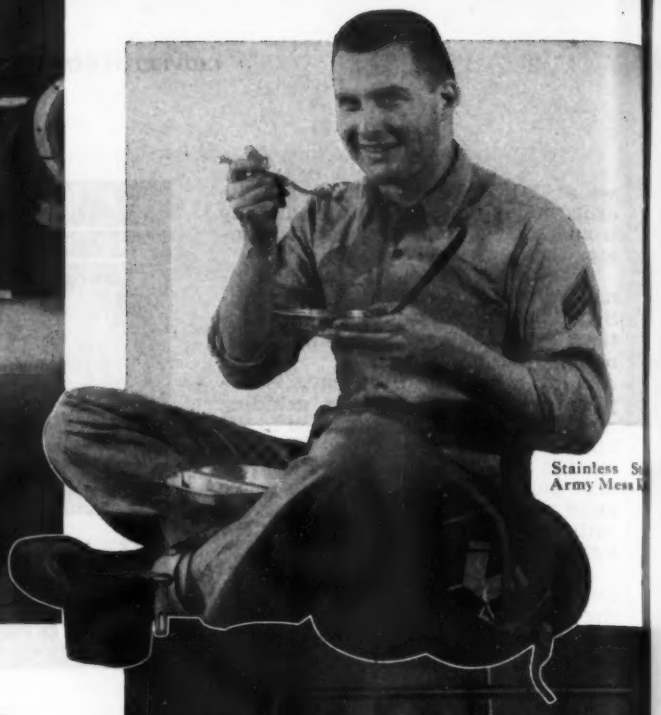


Stainless Steel in Aircraft Engine Manifold and Collector Rings



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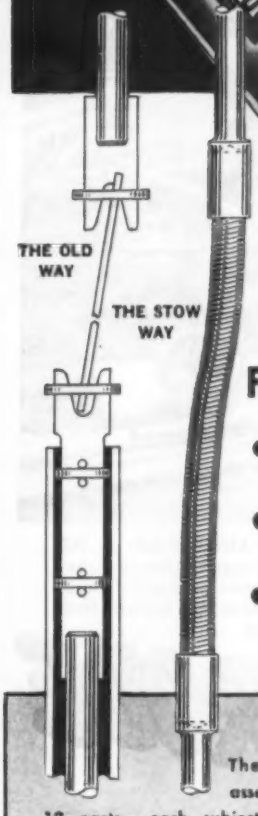

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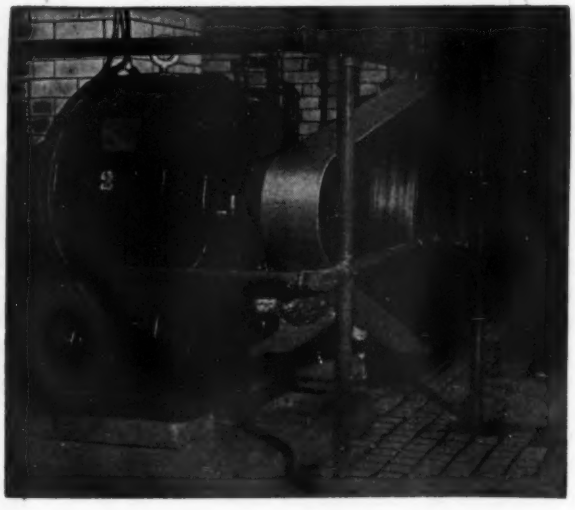

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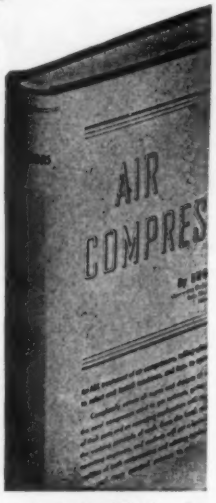

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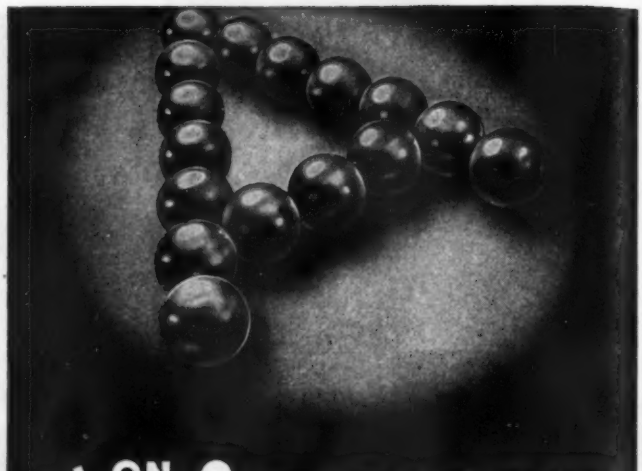

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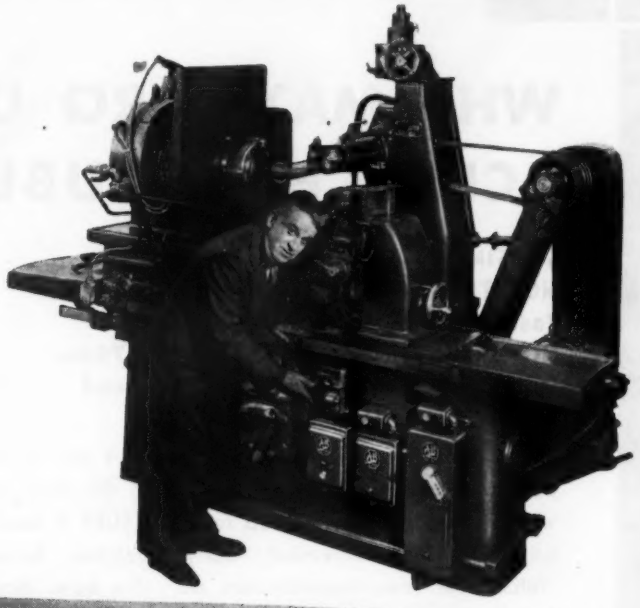

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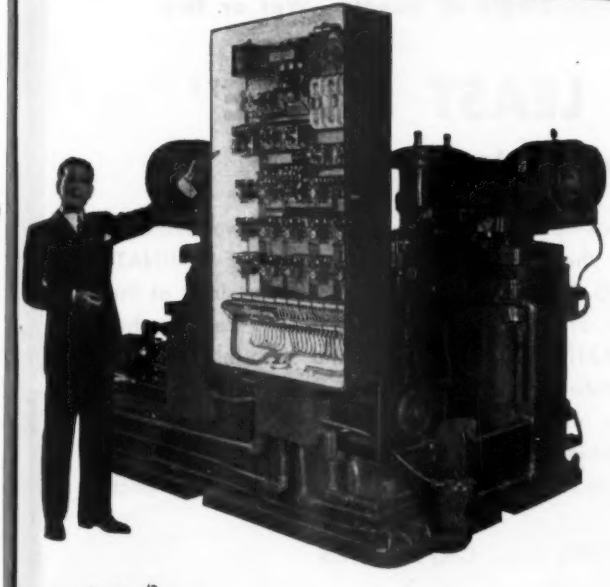

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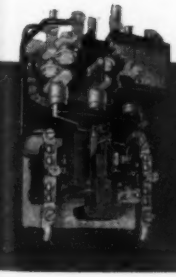

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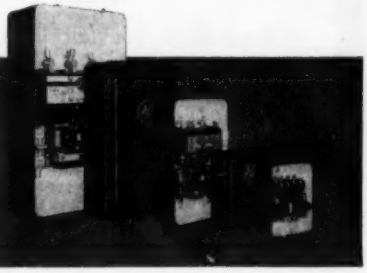

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. . . and they are not the only ones who appreciate the amazing *compactness* of the MAXITORQ CLUTCH. No machine designer is wasting space these days. No machine user need tolerate bulky, complicated old-time clutch, brake or reversing hook-ups when these functions are so well handled by the COMPACT, SIMPLE, TROUBLE-ELIMINATING MAXITORQ DISC CLUTCH. Just look at the list of real "User Benefits" . . . realize that MAXITORQS cost no more and often less than less satisfactory units. Then put in a call or write to our engineering department for help on your problems. Modestly we say . . . we know as much or more about clutches as anyone else in the field.

DOUBLE TYPE CLUTCH

TYPES . . . CAPACITIES

Maxitorq clutches are made in single (above) and double (left) types, wet or dry. Pulley and Cut-off Coupling types also made. Capacities from ¼ to 5 H.P. at 100 R.P.M.

SEND FOR CATALOG NO. A61

THE CARLYLE JOHNSON MACHINE COMPANY · MANCHESTER, CONNECTICUT

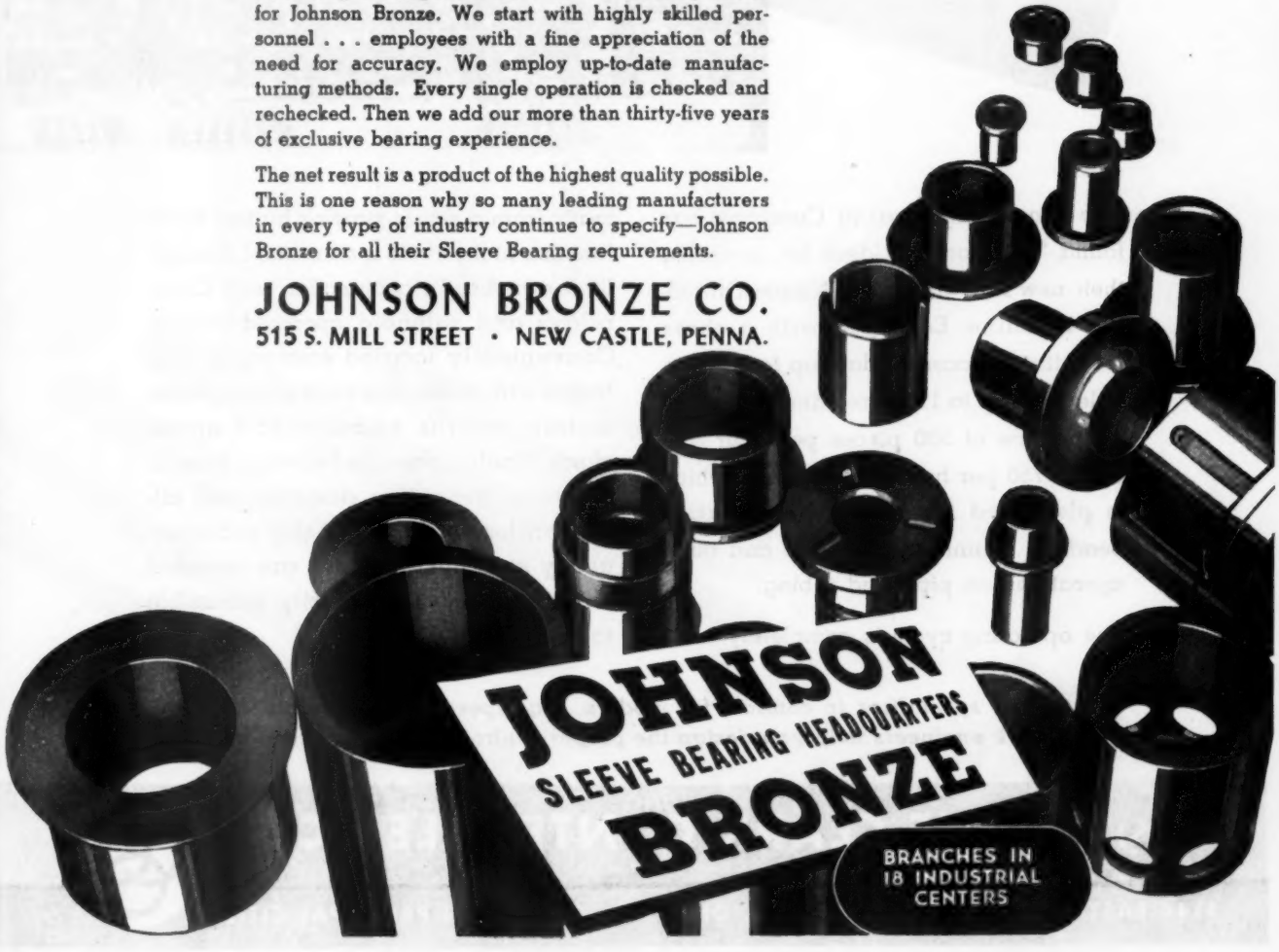
Correct

Sleeve Bearings cannot be "nearly right." In order to function properly . . . to deliver the utmost in performance for the longest period of time . . . they must be *correct* in every single detail. Every measurement must be precise. The alloy must be strictly according to specifications.

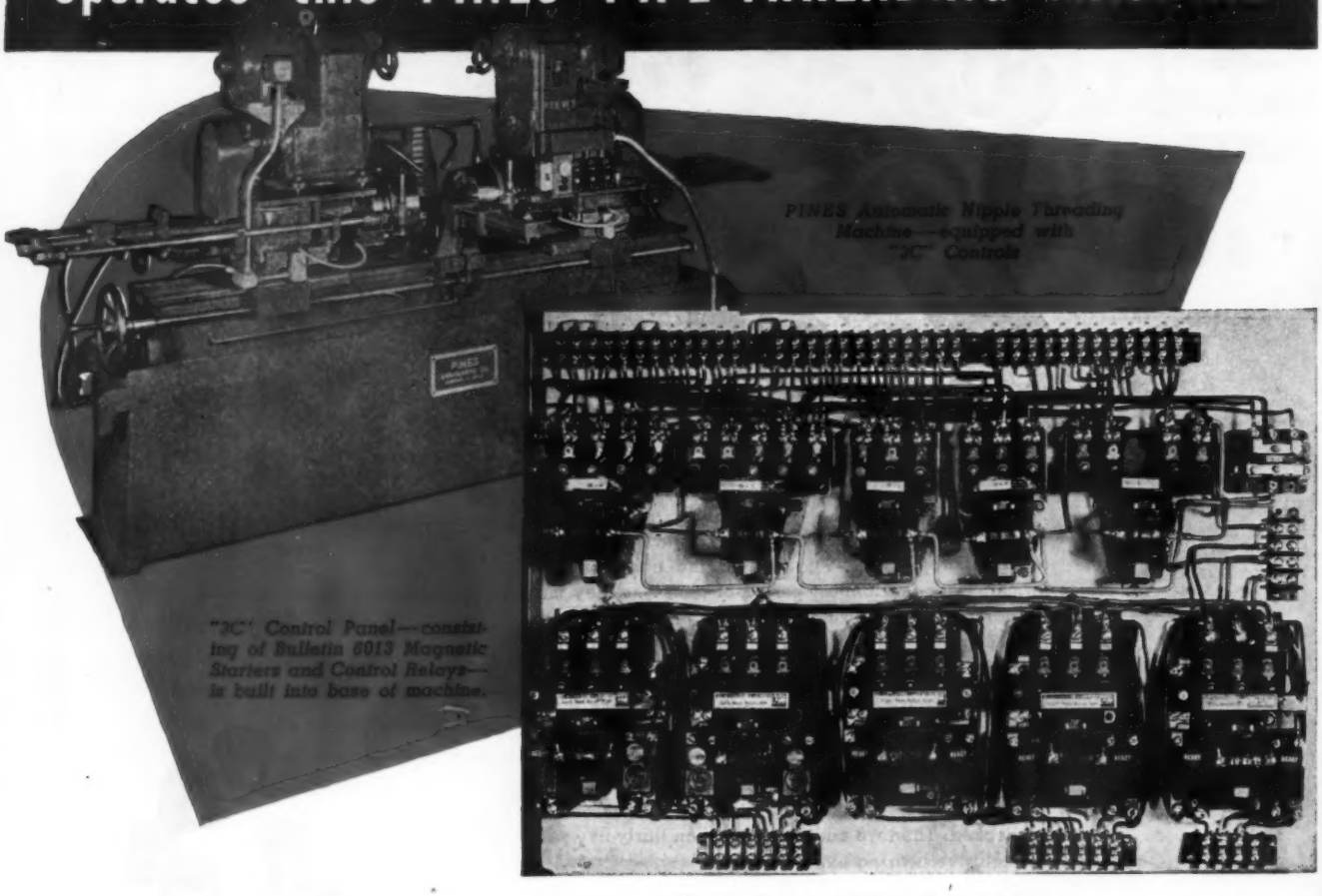
Producing bearings that are correct is an easy matter for Johnson Bronze. We start with highly skilled personnel . . . employees with a fine appreciation of the need for accuracy. We employ up-to-date manufacturing methods. Every single operation is checked and rechecked. Then we add our more than thirty-five years of exclusive bearing experience.

The net result is a product of the highest quality possible. This is one reason why so many leading manufacturers in every type of industry continue to specify—Johnson Bronze for all their Sleeve Bearing requirements.

JOHNSON BRONZE CO.
515 S. MILL STREET · NEW CASTLE, PENNA.



A SINGLE STARTING BUTTON plus "3C" CONTROL operates this PINES PIPE-THREADING MACHINE



PINES Automatic Nipple Threading Machine—equipped with "3C" Controls

"3C" Control Panel—consisting of Bulletin 6013 Magnetic Starters and Control Relays—is built into base of machine.

The Pines Engineering Company has found "3C" controls ideal for operating their new fully automatic Nipple Threading Machine. Equipped with a chute feed, it will accommodate up to 1" pipe, in lengths up to 12", threading 1" nipples at the rate of 500 pieces per hour and ½" at 750 per hour. The same machine is also used for chamfering, flaring, beading, spinning ends close and other operations on pipe and tubing.

The operating cycle is completely automatic from a single starting button. Each function in the cycle is controlled through limit switches in conjunction with Clark relays and solenoid operated valves. Conveniently located emergency stop button with mushroom head stops spindle motors, returns spindles and opens chuck. Control panel is built into base of machine, providing dust-tight and oil-tight enclosure. "3C" start-stop and emergency stop push buttons are mounted on front of machine—easily accessible to operator.

Clark specializes in controls for modern, high-speed machine tools. Let Clark engineers help you design the proper controls for your equipment.

THE CLARK CONTROLLER CO.

1146 EAST 152nd ST., CLEVELAND 10, OHIO • OFFICES IN PRINCIPAL CITIES

ENGINEERED

FOR PRODUCT AND MACHINE DESIGN

One of the most vital spots in production machinery and in many other engineered products is the feed line system . . . the hose or tubing which carries coolants, hot water, steam, compressed air, solvents, gases, chips, dust, etc. This is especially true when such feed or exhaust lines connect moving parts . . . where both enduring strength and extreme flexibility are equally necessary.

The solution of the problem definitely calls for Metal . . . AMERICAN Flexible Metal Hose and Tubing which combines the strength of metal with the flexibility of rubber for long life under even the most exacting conditions.

While American's engineers have designed thousands of special assemblies of tubing and couplings for specific duties, there are among them an infinite number of combinations which will solve almost any conceivable requirement for flexible connectors. When you consider that the cost of *one* "down-time" of a production machine, due to piping failure, will pay for the *best* Flexible Metal Tubing feed line system . . . it's time to specify "AMERICAN."

ASSEMBLIES

We show here a few special and standard assemblies of both American "Seamless" and strip wound tubing, together with the required couplings. Standard types are "Steamtite Connectors," used as steam lines on laundry presses; "Vibration Eliminators" for insertion in rigid pipe lines; and "Bracket-ubes," permanent steam connections on molding presses. Special assemblies cover so many applications that we can only say . . send us your blueprints for specific recommendations . . . our Engineering Department is at your service.

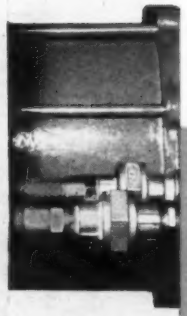
ANACONDA
from mine to consumer

American Metal Hose

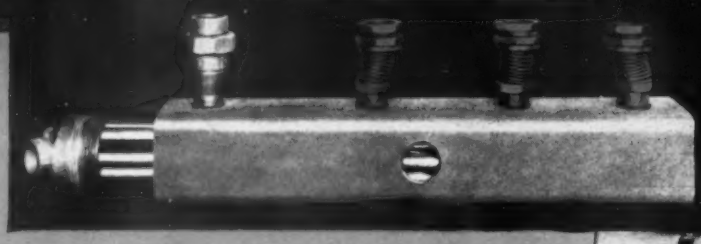
AMERICAN METAL HOSE BRANCH of THE AMERICAN BRASS COMPANY

General Offices: Waterbury, Conn. Subsidiary of Anaconda Copper Mining Company

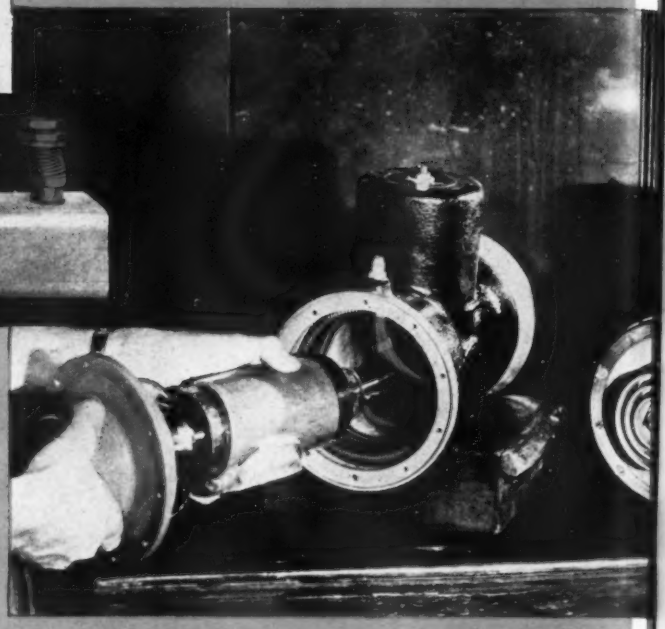
In Canada: Anaconda American Brass Ltd., New Toronto, Ont.



Left: High pressure air lines had to be fitted into a cramped space but the designer of this tube beader found the answer in American Seamless. Photo courtesy: Vaill Engineering Co.



These short flexible assemblies proved to be the solution in connecting this "Header-Heater" to sectional boilers. Flexibility Compensates for differences between Tappings. Photo courtesy: Burnham Boiler Corp.



American Seamless bends to small diameters and easily fits the "profile" of this x-ray tube while conveying water to cool the tube. Photo courtesy: Machlett Laboratories.

DESIGNED RIGHT FROM THE START

From the standpoint of feed lines, many of the country's leading machine and product designers are making sure of smooth functioning by getting American Flexible Metal Hose and Tubing on the drawing boards . . . "Right" . . . from the start.

American Flexible Metal Tubing contributes to operating efficiency in many ways. It has strength beyond other materials . . . flexibility that makes it last even after millions of constant flexings; it will absorb machine vibration; it is easily installed; it can be made of alloys that resist corrosion, abrasion, gases, extremes of temperature . . . it easily handles oil, steam and many chemicals; some types can be bent to any desired position and will "stay put."

American Flexible Metal Hose assemblies are frequently used to connect and compensate for misaligned tappings . . . some are used as protective sheathing for delicate wiring or capillary tubing in recording instruments, X-ray machines, electrical appliances, etc. We will gladly send you bulletins and technical literature covering our products . . . or submit your specific problem to our Engineering Department for recommendations.

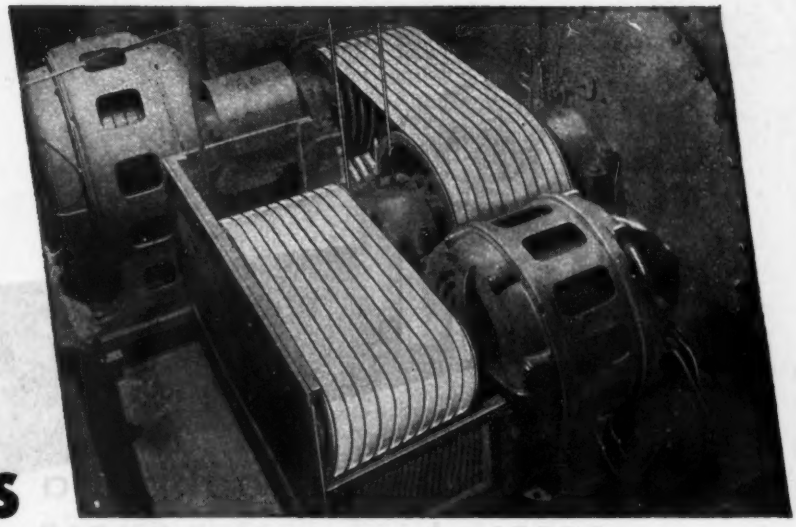
The "Life Lines" of your product or machine should be American. Get them "Right" . . . from the start. 45256

AMERICAN METAL HOSE BRANCH OF THE AMERICAN BRASS CO.

General Offices: Waterbury 88, Conn. • • Subsidiary of Anaconda Copper Mining Company

ANACONDA

In Canada: Anaconda American Brass Ltd., New Toronto, Ont.



Today-

Your *Standard* GATES V-Belts

—Made of *Synthetic* Rubber—

are out-performing *ANY* V-Belts ever made of *NATURAL* Rubber!

No V-Belts built by *anyone* before the war could stand the service now daily delivered by Gates V-Belts on army tanks, tractors and self-propelled big guns. Gates developed these greatly superior V-Belts through intensified, specialized research—and Gates is building these belts entirely of *synthetic rubber.*

This fact is now important to YOU —— and here is the reason:

● **Every improvement developed by Gates for these Army V-Belts has been added, day by day, to the quality of the standard Gates Vulco Ropes which have been delivered to you.**

In the case of many *other* products, as you know, you must wait until after the war to get the benefits of war-time improvements. But victory depends so directly upon production and production so directly upon V-Belts which drive the producing machines, that Gates has been able to give you *immediately,* in your Standard Gates Vulco Ropes, every V-Belt improvement which Gates specialized research has developed for use in the Army's motorized equipment.

In addition, where V-Belts of special construction are required, your Gates Rubber Engineer is in position to supply a Gates V-Belt that is precisely engineered to meet your special needs.

Whatever drive problem or V-Belt problem you may have, you need only to pick up your phone book and look under the heading "Gates Rubber." The Gate Rubber Engineer will bring right into your plant the full benefits of every advance in V-Belt construction and in drive operation that Gates specialized research has developed.

NOTE: GATES ALSO MAKES THESE SPECIAL BELTS TO MEET EXCEPTIONAL SERVICE NEEDS-

- Rayon Cord V-Belts
- Static-Safety V-Belts
- *Special* Synthetic V-Belts
- Cotton Cord V-Belts
- Steel Cable V-Belts

THE GATES RUBBER COMPANY

Engineering Offices and Jobber Stocks in All Large Industrial Centers

Gates
The Mark of Specialized Research

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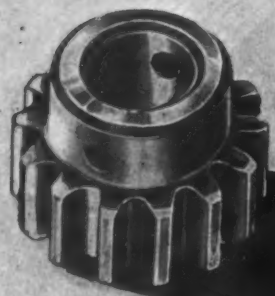

are you overlooking a STEEL that may DOUBLE your production . . .

SPEED CASE STEEL

There in no other ONE STEEL which combines all SPEED CASE properties

The Machinability, Ductility, and Tool Saving qualities of SPEED CASE STEEL are only three of the properties of this revolutionary steel which are making past production records obsolete. In many plants it eliminates one or more operations in annealing and finishing. In others it is being deformed cold instead of after heating. Tool life is usually doubled and savings up to $70 per ton used are the rule, not the exception. Why carry a large inventory of different steels when ONE STEEL—SPEED CASE—will satisfactorially replace all other low carbon and Bessemer steels.

SPEED CASE REPLACES
C1117
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C1019
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Licensee for Eastern States

THE FITZSIMONS COMPANY

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HAMMOND · INDIANAPOLIS · CHICAGO

PECKOVER'S LTD. Toronto, Canadian Distributor

MANUFACTURERS OF COLD FINISHED CARBON AND ALLOY STEEL BARS

Send me this VALUABLE NEW SERVICE

—which I understand will help me to use Arc Welding to better advantage.

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"PRACTICAL DESIGN FOR ARC WELDING"
—will put your imagination to work on the use of welding.
IDEAS GALORE LOOSE LEAF FORM
—clear and simple drawings easy to understand and apply.

Simplified ARC WELDING

Now is the time to plan to use welding on your future production—to take advantage of experiences gained—to cut costs and yet build a better, stronger product. "Practical Design for Arc Welding" can help you plan. Ask for this service today.

HOBART Bros. Co.

Box AM. 6-7, Troy, Ohio, U.S.A.

One of the World's Largest Builders of Arc Welders

The Spring Washer holds all parts tight

There are 4 or more parts in most bolted assemblies—a nut, a bolt, and 2 or more parts to be held together. So long as there is even the slightest pressure between the threads of the nut and of its bolt, the nut never budges; but meantime vibration is wearing all the other parts loose. Wherever metal touches metal there is inevitable wear.

That's why a strong spring washer must be used. Nothing but a spring can retard this initial wear, and expand to hold the whole assembly tight.

No matter whether you use a regular standard nut or one of the many fixed or lock-nuts, be sure to specify Kantlink spring washers for real bolted security.

Let us send you samples—send details of your application. Test and compare them on the same job with any type of nut, or with any other type of washer.

Our Kantlink Spring Washers conform to Ordnance Standard Specification BECX 1-2-3-, and Army-Navy Aeronautical Standard AN 935, and U. S. Navy drawing 12-Z-22.

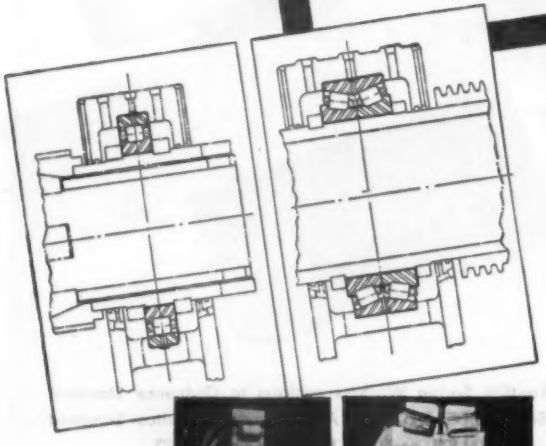
Originators of KANTLINK the long-range spring washer

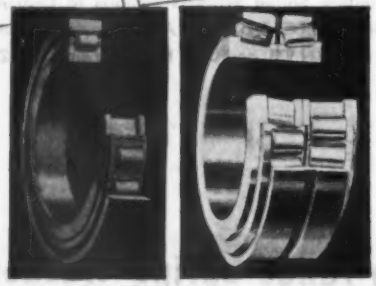
NATIONAL LOCK WASHER COMPANY

NEWARK, NEW JERSEY, U. S. A.

TORRINGTON BEARINGS HELP BOMB SPINNERS ACHIEVE NEW SPEEDS

Drawing from photograph of bomb spinning machine manufactured by W. S. Bowling.





X-section shows a single row straight radial roller bearing, and a 2-row tapered roller bearing designed and built by Torrington's Bantam Bearings Division to speed operation of bomb spinning machines. Our engineers specialize in designing and building to unusual requirements.

At the start of the war, Torrington was asked to design and build bearings that would enable the spindles of bomb spinning machines to operate at speeds up to then thought impossible. Soon, spindles equipped with large tapered and cylindrical Torrington Roller Bearings were turning at unheard-of speeds up to 1500 revolutions per minute, with equivalent pitch line speeds of 8000 feet per minute.

On the typical Torrington Bearing equipped spindle, the heavy alternate radial and thrust loads on the fixed end of the spindle are carried by a rugged, compact double row tapered roller bearing. A single row straight radial roller bearing supports the floating end of the spindle, allowing lineal expansion to take place without cramping. Special design features at the picket corners of the bearing cage take care of the rapid alternation between radial and thrust load. A specially designed automatic lubrication system handles the excessive heat generated by the unusual operating conditions.

Designing and building bearings to meet unusual anti-friction requirements is the year-round job of Torrington's Bantam Bearings Division. Our help and cooperation are at your disposal, for projects present or postwar.

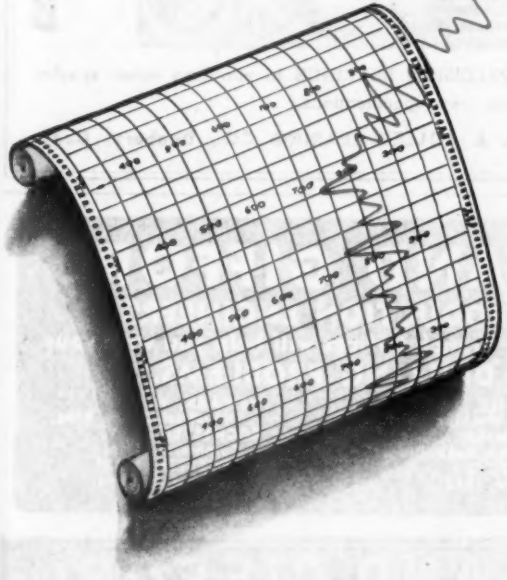
THE TORRINGTON COMPANY · BANTAM BEARINGS DIVISION
SOUTH BEND 21, INDIANA

TORRINGTON BEARINGS

STRAIGHT ROLLER · TAPERED ROLLER · NEEDLE · BALL

CLEAR TRACK

FOR A NERVE-TWITCH



Most Complete Line in America

It takes a mighty "light hand" to measure and control temperature changes as delicate as a maiden's blush. In the super-sensitive potentiometer and other process control instruments, the tiniest hesitation anywhere in the complex system of levers and linkages can produce a costly upset. That was the problem one instrument maker put up to Fafnir . . . to help create a clear, friction-free track for thermal and electrical impulses as minute as a nerve-twitch. Fafnir did it . . . with a series of precise, extremely small bearings, ranging from ⅜" to ⅞" outside diameters. At fourteen critical points Fafnir jewel-like ball bearings enable delicately balanced levers to pivot and cam followers to roll free of friction . . . without a trace of "dead-space effect."

The same Fafnir engineering skill and experience are available to you for the widest possible range of bearing problems. Why not use it? The Fafnir Bearing Company, New Britain, Connecticut.

★ 2196

FAFNIR BALL BEARINGS

Need extra GRIPPING POWER? Specify *Mac-its*

Mac-it **alloy steel square head set screws are milled from the solid bar with die-cut threads. Heat-treated for maximum torsional strength and to resist upsetting of the points.**

Mac-it Products Include: Socket Head Cap Screws, Hollow Set Screws, Hexagon Head Cap Screws, Square Head Set Screws, Stripper Bolts, Hexagon Socket Pipe Plugs.

STRONG, CARLISLE & HAMMOND CO. · Cleveland 13, O.

Darwin

PRK-33 COBALTCROM

Air Hardening, Non-Deforming, Cobalt High-Carbon, High Chromium Steel

A tool steel with an original basic formula of our own specifications.

Recognized for long die life and unsurpassed quantity production runs.

Outstanding characteristics are simplicity of treatment, uniform hardness penetration to the center, secondary hardness, extremely high tensile strength, resistance to abrasion.

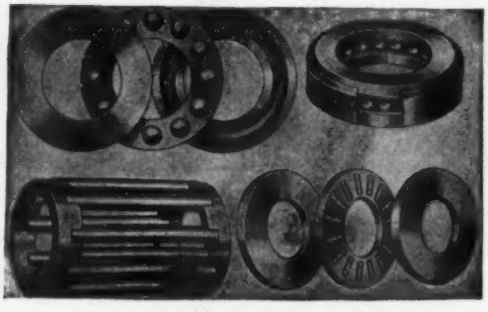
Ideal for blanking, drawing, forming, trimming and shearing tools.

Furnished in Bar Stock, Billet, Forging, Casting and Welding Rod. Bulletin on Request.

DARWIN & MILNER Inc.

highest grade tool steels

1260 W. FOURTH ST. CLEVELAND 13, OHIO



B & R B

B & R B PRECISION BEARINGS in standard sizes, special sizes to your own specifications.

THE BALL & ROLLER BEARING CO., Danbury, Conn.

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DRILLING PROBLEMS.

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AO CLOTHING FOR HOT WEATHER WELDING

AO Short Jacket No. 203CL: Full protection for arms, neck, chest and shoulders.

AO Cape Sleeve and Bib No. 208B-CL: Complete protection for shoulders, arms and front of body. Detachable bib.

AO Sleeves No. 209CL: Excellent protection for arms only.

Here are comfortable garments for warm weather bench welding, cutting and burning. Made from high grade chrome tanned leather, these garments provide ample protection for those parts of the body which are exposed. Yet, they eliminate the necessity of wearing hot, heavy clothing over parts of the body which are not in danger from sparks or molten metal.

AO carries a complete line of welders' clothing — jackets, pants, overalls, spats, leggings and gloves. Send to your nearest AO Branch Office or direct to the company for complete information.

American Optical

COMPANY

SOUTHBRIDGE, MASSACHUSETTS

Johnny Gets a Gun

and AMERICAN PHILLIPS SCREWS...

Discard slow hand-driving on your screw assemblies. Arm your workers with American Phillips Screws . . . which fit onto the 4-winged bits of power-drivers as straight and firm as fixed bayonets. Then watch output soar, while costs, spoilage and rejects dive! For even unskilled workers can drive these *self-aligning* American Phillips Screws with bullet-like speed and accuracy, straight to the mark, every time. No fumbling, no scarred work-surfaces, no crooked or broken screws. Time savings climb as high as 50% over slotted screws.

And here's another advantage over slotted screws: Where stress is a factor, the allowable load (in pounds per screw) is far greater with Phillips . . . *24% greater, according to tests in one of the biggest bomber plants in this country.*

All these advantages sum up to one plain fact: For *any* screw-driving job, in small shop or large plant, *American Phillips Screws cost least to use.* And American adds extra savings by its individual inspection of screw heads, threads, and points . . . also by automatic weigh-count that assures full quantity in every order. Try American Phillips Screws on your own assemblies.

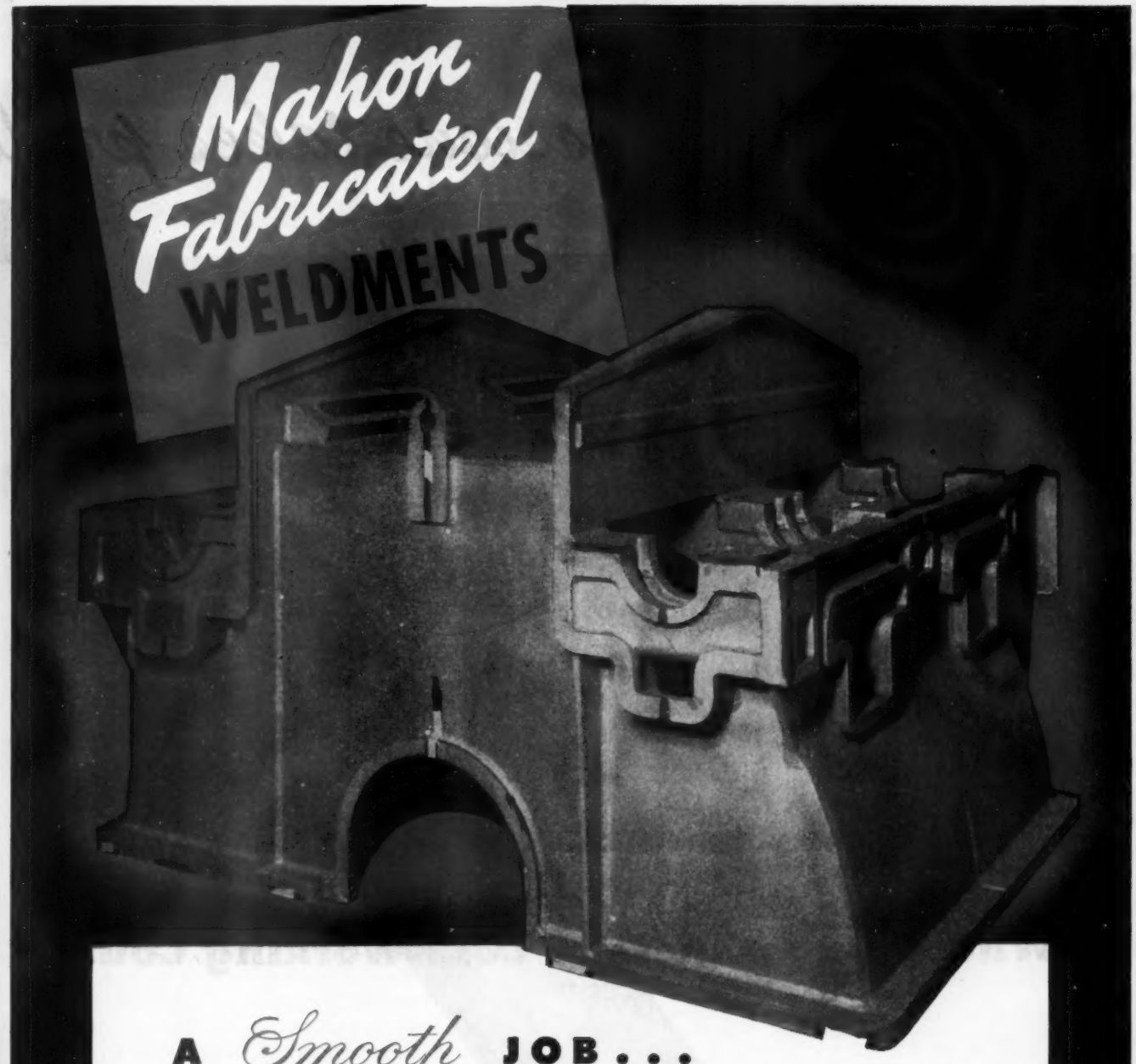
AMERICAN SCREW COMPANY, PROVIDENCE 1, RHODE ISLAND

Chicago 11: 589 E. Illinois Street — *Detroit 2:* 502 Stephenson Building

PUT THE SCREWS ON THE JAPS... BUY WAR BONDS

AMERICAN PHILLIPS *Screws*

Mahon Fabricated WELDMENTS



A *Smooth* JOB . . . EVEN IN THE *Rough*

Here is visible evidence why Mahon Weldments cut machining and finishing costs.

This unretouched photograph of a gear housing section is exactly as it came from the hands of Mahon fabricators—with strips of the marking tape still adhering. No machining—no painting—no finishing of any kind has been done.

It tells its own story of the quality of welding skill for which Mahon has earned such widespread recognition.

Mahon engineers will welcome the opportunity of collaborating on your *welded* steel plate requirements.

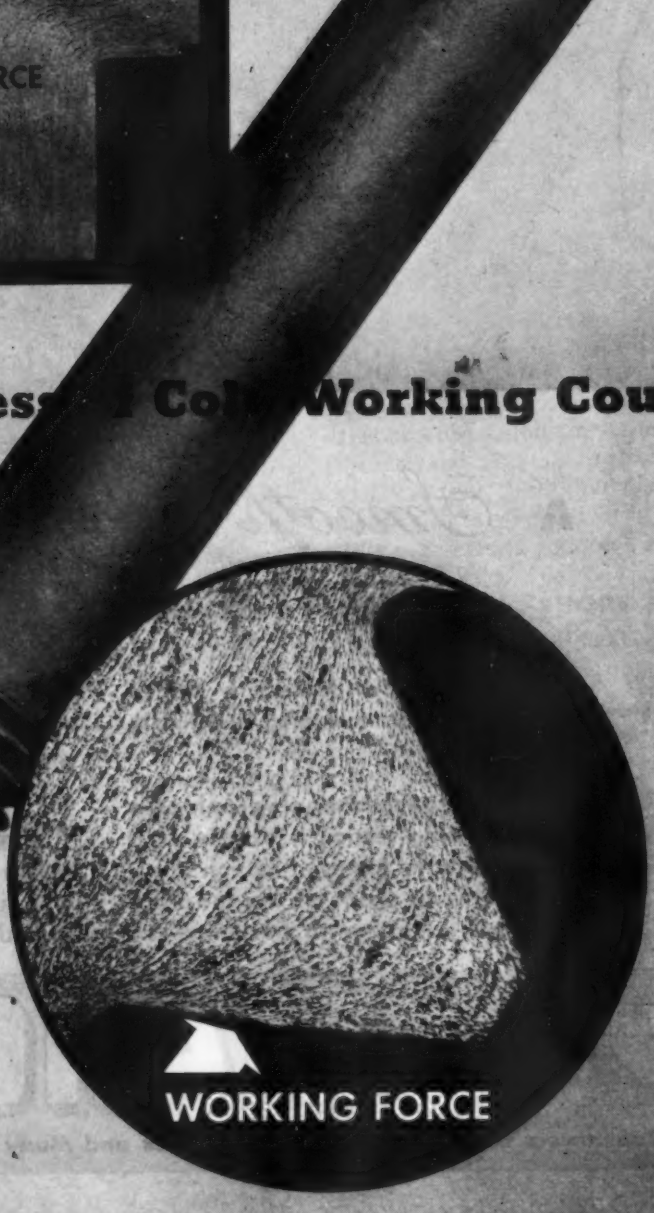
THE R. C. MAHON COMPANY

DETROIT 11 — CHICAGO 4

Fabricators of Machine Bases and Frames and Many Other Welded Steel Plate Products

Lamson & Sessions takes pride

Where Smoothness ... Cold Working Counts



IN THE EXCELLENCE AND UNIFORMITY OF ITS COLD FORGED PRODUCTS MADE BY THE MOST MODERN METHODS . . .

• Modern metals helped make possible the success of modern cold-working methods of bolt production. Cold-working methods themselves contribute to the final result in a *stronger* product held to *closer* tolerances and with a *finer* finish.

Cold-forging (upsetting) produces smoothness of contour and symmetry of grain flow in the upset section—the head of the bolt. Rolled threading produces smoothness of thread form, and insures smoothness of surface and freedom from the weakening effects of tears and fractures in the threaded section. Finally, cold-working in all these phases produces smoothness and uniformity in dimensional control and finish *on a production basis.*

Microscopic examination reveals that surfaces of parts which have been cold-worked by upsetting, extruding and rolling of threads are less susceptible to fatigue cracks than surfaces formed by other methods which are commonly used. In the modern heat treated fastening it is important to reduce "notch sensitivity" (occurring at threaded section), since heating and quenching opens tears and fissures and sets up stresses and chills which shorten the life of the fastening. Similarly, on plated products tears and fissures cause unequal deposits of plating, and consequent unequal fits and distribution of force on the threads and head. Cold rolling produces round radii of thread roots, and tests show that these rounded radii *increase fatigue strength up to 150%!*

The increase in strength of the headed and threaded part by cold-working enables our customers to use lighter, stronger parts—which further strengthens their own product and reduces their costs. Additional savings result from the use of round wire instead of cold drawn bar stock, a much higher rate of production, and virtual elimination of wasted stock in the form of chips and turnings.

Lamson engineers have the "know-how"—and will gladly talk over your fastening problems and discuss the possibilities of your use of cold-forged products for the benefits mentioned previously. No obligation is involved when we talk it over.

THE LAMSON & SESSIONS COMPANY, General Offices, Cleveland, O.
Plants at Cleveland and Kent, Ohio; Chicago and Birmingham

"BOLTS, NUTS & SCREWS"—1944 REVISION. Cloth bound. Limited edition, 180 pages of technical, practical information. Sent prepaid for *$1.00—cash or check must accompany your order.*

"BOLTS ARE IMPORTANT!"—24-page booklet of currently useful information for buyers of headed and threaded products, and describing Lamson & Sessions' specialty fastenings which have wide industrial applications *—now, and in the post-war period. Sent gratis.*

"THE LAMSON BLUE BOOK"—is our standard Catalog of standard products excepting our Aircraft products. *Sent gratis.*

"SIMPLIFIED STOCK LIST"—Of bolts, nuts and screws, conforming to latest revisions of the Office of Price Administration, and of great value in showing you in what ratio quantities of various standard products are kept in stock for deliveries, by your jobbers and in our own (and other bolt manufacturers') warehouse stocks. *Sent gratis.*

----HERE'S A COUPON FOR YOUR CONVENIENCE----

THE LAMSON & SESSIONS COMPANY • 1971 West 85th Street • Cleveland 2, Ohio

Please send us ☐ Lamson Blue Book ☐ Bolts, Nuts and Screws ($1.00)
☐ Bolts are Important! ☐ Simplified Stock Sizes

Send information on ☐ Cap Screws and Set Screws ☐ Cotters
☐ Bolts ☐ Machine Screws ☐ Lamson Lock Nuts
☐ CP,HP,SF Nuts ☐ Lock-washer Screws ☐ Self-Tapping Screws

Name of Individual _____ Title or Kind of Work

Employed by (Name of Company) _____

Street Address _____

City and State _____

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LAMSON & SESSIONS

BOLTS · · NUTS · · COTTERS · · CAP SCREWS · · SPECIALS

Your Jobber Stocks the Lamson Line

NOS. 0000, 000, 00 AND 0

ARE *Big* PRODUCTS

— big in their importance to the manufacture of precision instruments, for they are the *almost infinitesimal* screws that are used in the assemblies of many of the world's finest mechanical masterpieces.

For more than half a century Waltham has specialized in the production of *precision* screws. Its plant and equipment have steadily modernized and expanded to meet the demands of every period of business development and the exacting needs of three wars.

Waltham is tooled to produce fine screw machine products *for a million uses* — any thread, material or finish — any type head, from 1/64" to 1½" diameter.

America's Outstanding Producers of Fine Instrument Screws

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77 Rumford Ave.
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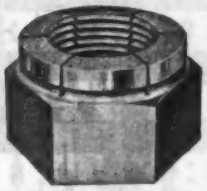
Why you Should order the FLEXLOC STOP and LOCK NUT



Pat'd—Pats. Pend.

Because:

- It is of one-piece construction
- It can be made of any of the conventional nut materials
- Every thread—including locking threads—takes its share of the load
- Its construction is especially advantageous for maximum strength and dependability of low and thin nuts
- It accommodates itself to a very wide range of thread tolerances
- It can be used over and over again without losing its ability to lock
- It is not affected by temperatures likely to be met within the field of Mechanical Engineering
- Being a "stop" nut, it stays locked in any position on a threaded member.

Sizes from No. 6 to 1" diameter

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designed to ELIMINATE COOLANT PROBLEMS

Model TL-7320

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For steady, trouble-free operation, specify Gusher Coolant Pumps on your machines. There is no need for priming . . . packing. The full ball-bearing design, rigid one-piece shaft, and sturdy overall construction of Gusher Coolant Pumps, assure you of longer life, less maintenance cost, and uninterrupted, dependable service.

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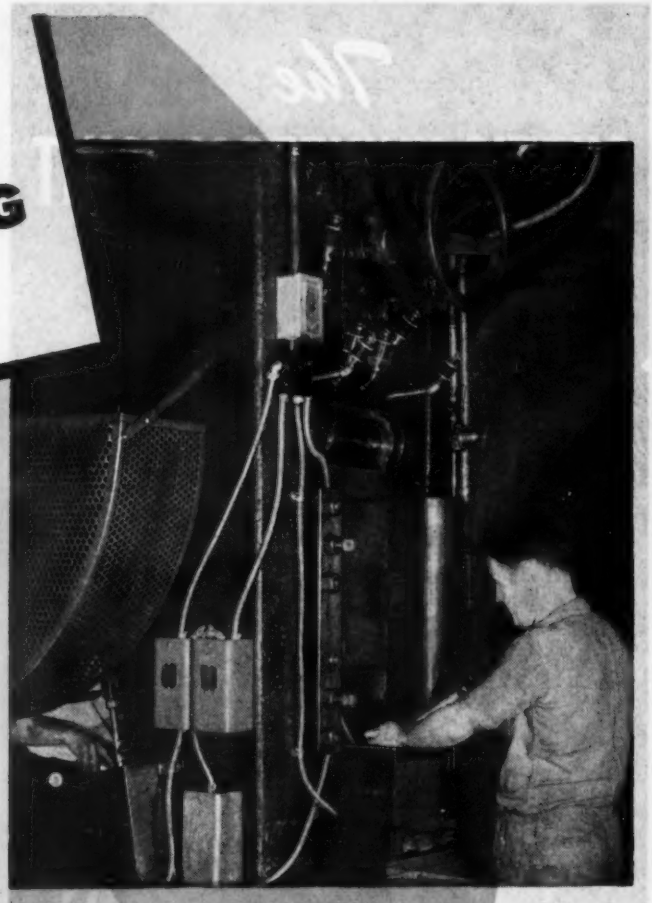
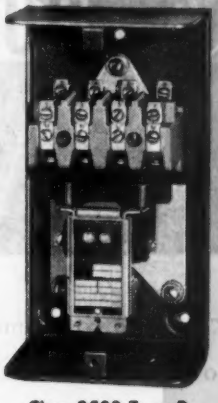
SQUARE D HEAVY DUTY CONTROL & TIMING RELAYS

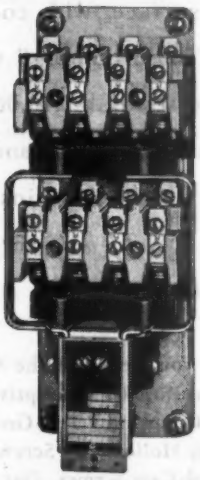


"Naturals" for reconverting or modernizing electrical control because they're designed for simplicity of operation and flexibility of application.

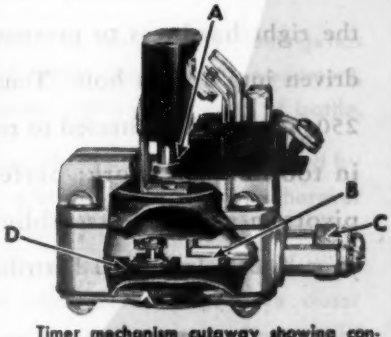
Class 9050 timing relay for .2 to 180 seconds delay.



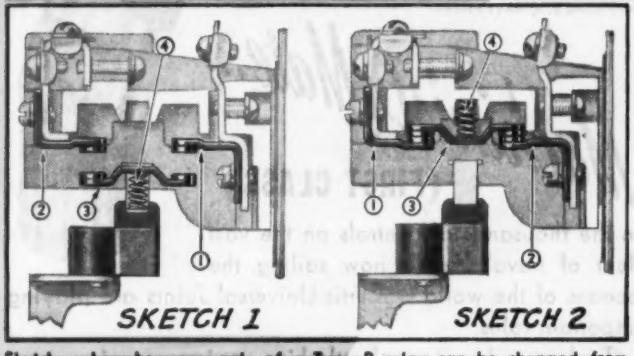
Class 8502 Type R four pole relay.



Eight pole Class 8502 Type R relay.



Timer mechanism cutaway showing construction and method of operation. Spring action (A) moves contact member as quickly as air can transfer from lower to upper chamber through the restricted orifice (B). Turning the knurled wheel (C) regulates amount of restriction. A check valve (D) allows instantaneous resetting.



Sketches show how any pole of a Type R relay can be changed from normally open to normally closed (or vice versa) without additional parts. When parts numbered 1, 2, 3, and 4 in sketch 1 are removed and reassembled as in sketch 2, the contact is changed from normally open to normally closed.

Write for Bulletins 8502 and 9050. Square D Co., Industrial Controller Div., Milwaukee 12, Wis.

Call in a Square D Field Engineer

Your nearest Square D field engineer can help you find the right answers to your problems in expanding or modernizing electrical control systems. This counsel is available, without cost, through branch offices located in 50 leading U. S. and Canadian cities.

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Tankers, submarines, battleships, cruisers, carriers, etc., require a multitude of valves, steering apparatus, and other mechanisms where transmission of power or positive control of shafting around corners or at angles is necessary.

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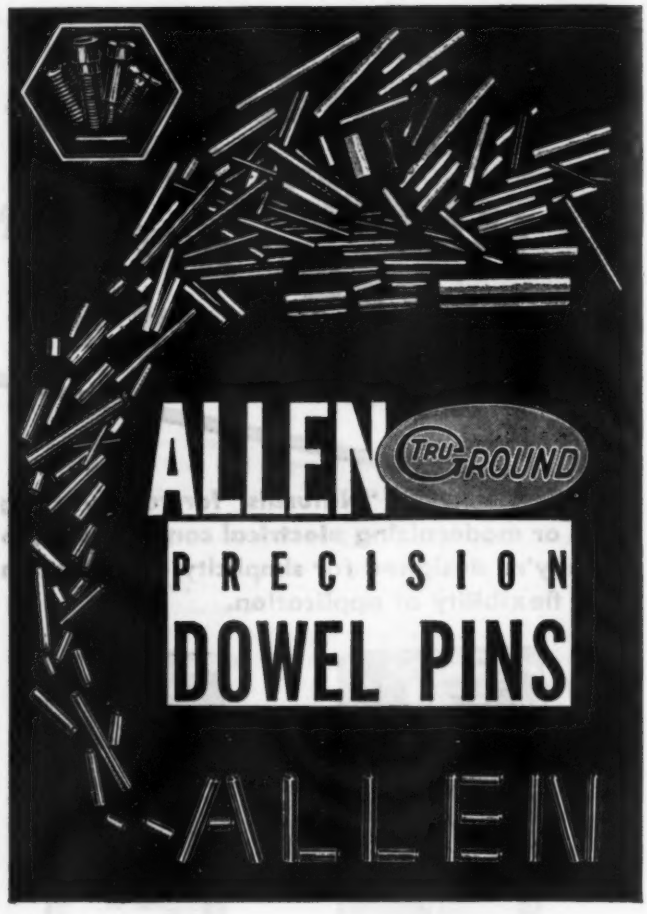
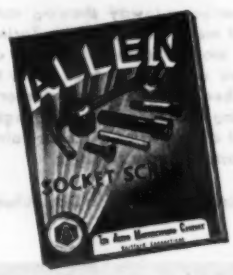
SOLE DISTRIBUTORS, BOSTON GEAR WORKS, NO. QUINCY, MASS.



ACCURATE to a limit of .0002" over basic size, with allowable tolerance of plus or minus .0001". Ground, polished surfaces, treated with rust-preventive... Heat-treated to an extremely hard surface, with core of the right hardness to prevent "mushrooming" when driven into a tight hole. Tensile strength 240,000 to 250,000 p. s. i. . . Steeled to retain precision standards in tool and die work; perfect shafts for pins and pivots in machine assemblies. . . *Sold only* through your ALLEN Industrial Distributor.



Let us send you a copy of the ALLEN 32-page Catalog of descriptive and dimensional data on "Tru-Ground" Dowel Pins, Hollow Set Screws and Socket Head Cap Screws, Flat Head Cap Screws, Socket Head Shoulder Screws, Hexagon Key Kits and other Allen products of prime interest in simplifying your fastening problems.

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stand up under severe strain and continual overloading in GAR WOOD CRANES & WINCHES

Gar Wood Wrecking Cranes and Winches are used by the armed forces on every battlefront. Orange Roller Bushings are installed in the majority of this equipment. The Tank Recovery Unit (top) uses Orange Roller Bushings as sheave bearings in the two 60,000 lb. pull winches. Wrecking Cranes (left) use Orange Roller Bushings in boom pivot and topping pivot. Also used in adapter gear of power take-off in front end winches of Army 6x6 trucks.

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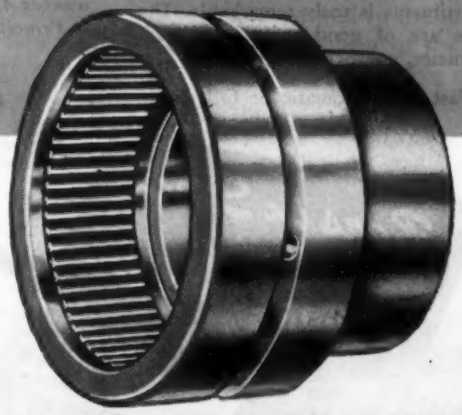

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As a part of Ampco's program to provide American industry with a *complete service* on copper-base alloy parts, the continuous-casting process has been applied to the production of mill-length rods of certain bronze alloys.

This process, exclusive with Ampco as to bronzes, results in rods of close tolerance and a soundness not commercially available until now. The fine, even dispersal of the secondary constituents is truly remarkable. The rods are of good surface, uniform diameter, and even length.

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Write for Data Sheet 131, showing photomicrographs and properties. *Ampco Metal, Inc., Dept. AM-6, Milwaukee 4, Wis. Ampco Field Offices in Principal Cities.*

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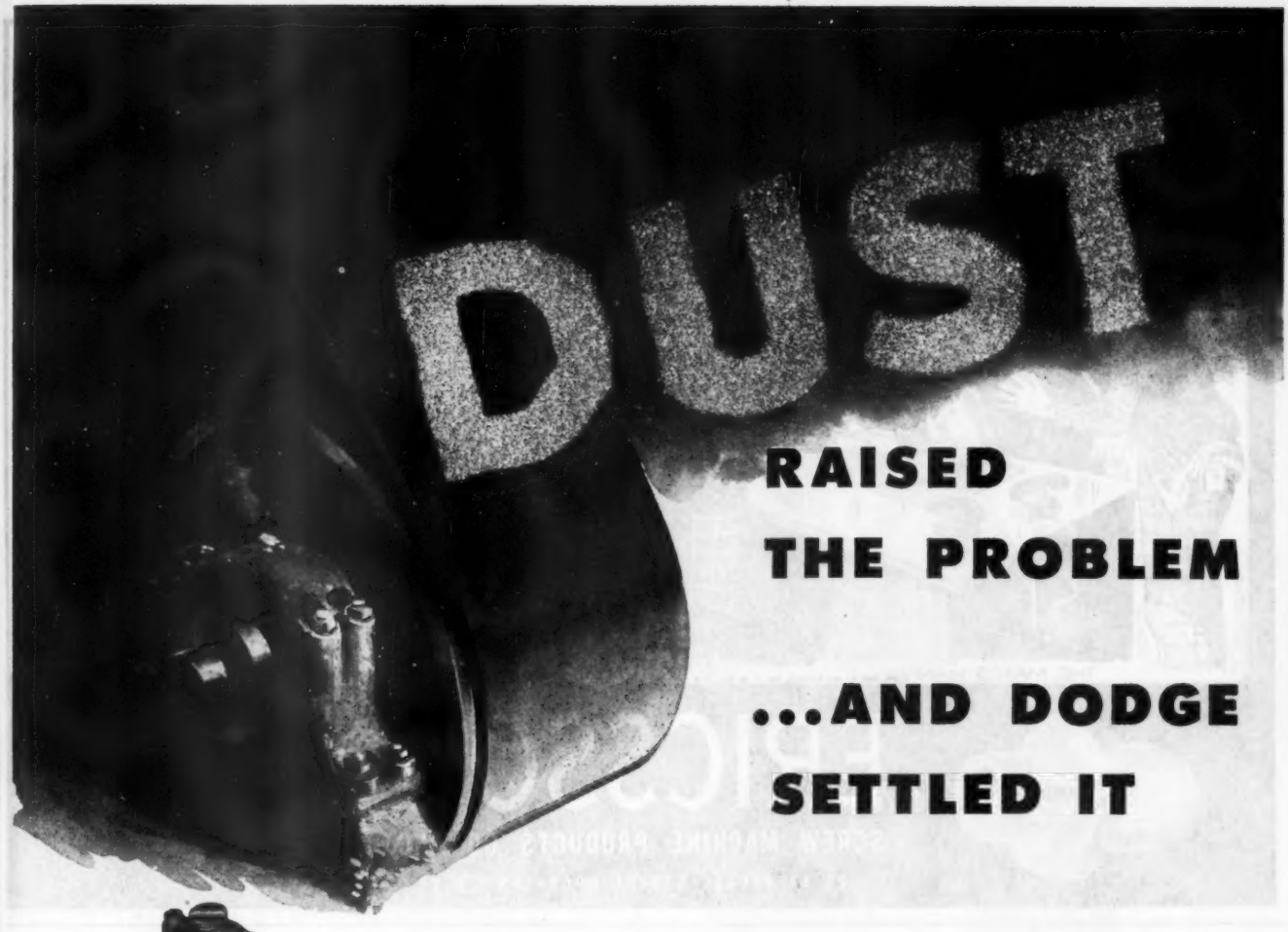
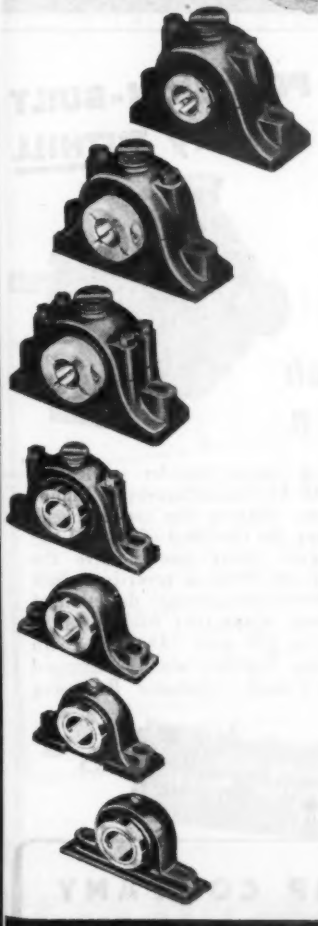


RAISED THE PROBLEM ...AND DODGE SETTLED IT



Destructive dust, working its abrasive havoc inside bearings, has been one of industry's toughest problems—especially in steel mills, foundries, cement, gypsum, abrasives, roofing and similar plants. Dodge attacked this problem—*and settled it*—with the Dodge-Timken Type C Bearing. Transmissioneering skill devised a seal which prevents seepage of abrasive dust to the polished surfaces of the bearing.

Now, plants in which these destructive materials are encountered in the manufacturing process can have a smooth flow of power, with a minimum of maintenance. Dodge-Timken Type C Bearings may be literally buried in abrasive dust, yet they operate efficiently, under heavy loads and at high speeds.

Dodge-Timken Type C Bearings are assembled, lubricated and adjusted at the factory. They are available in distributor's stocks. Call the Dodge Transmissioneer in your territory for information about these and other new developments in power transmission equipment, to help increase production efficiency and lower power costs.

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MISHAWAKA • INDIANA

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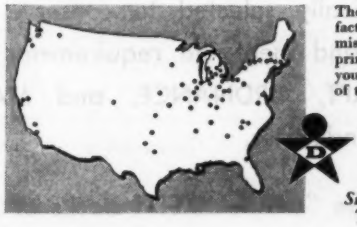

There are 210 Dodge factory graduate Transmissioneers, located in principal cities, to show you new and better ways of transmitting power.

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DODGE ROLLING BEARINGS • • • THE 30,000 HOUR LINE

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YOU PROMISED TO TAKE LOOK AT DEM NEW DRAWINGS FIRST
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YEAH! HE'S MORE POPULAR THAN A BUTCHER WITH A FRESH SHIPMENT OF BEEF
THE MAN'S MAN
J.R.WILLIAMS

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There's no war map in the Old Bull's office. Fighting men mean more to him than fighting news. No matter how good or bad the news—he wants those fighting men fully supplied up to the minute the last shot's fired. And supplied with the *best*. Supplied with the kind of fine precision goods that saved the nation millions of dollars because it was precision on a *mass-production, low-cost basis*. And what the nation has saved in war-dollars—will be saved by millions in peace-dollars when better precision products are produced for tomorrow's America.

(Below) Some of the many thousands of our precision parts that help "Keep 'em flying and fighting." Let's all back the attack—Buy EXTRA War Bonds.

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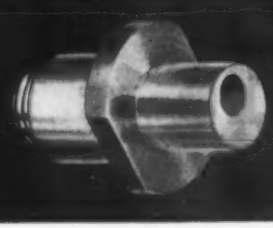

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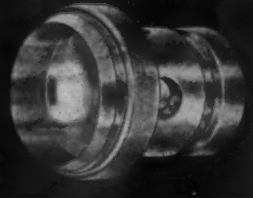

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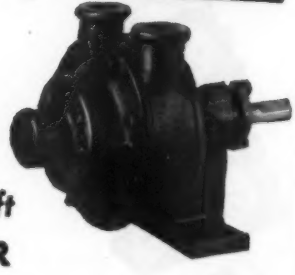

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. . . IT'S MODEL R

For lubrication, coolant or liquid transfer service on reversing machinery, Tuthill Automatic Reversing Pumps offer the practical solution. Without the use of check valves and without changing the direction of flow of the pumpage, these internal-gear rotary pumps solve the problem of driving the pump from a reversing shaft and provide the answer where the ultimate direction of shaft rotation is not known. Capacities from 1 to 50 g.p.m. and pressures up to 100 p.s.i. Available with or without internal-relieving feature; also in stripped model form. Write for Tuthill Automatic Reversing Pump bulletin.

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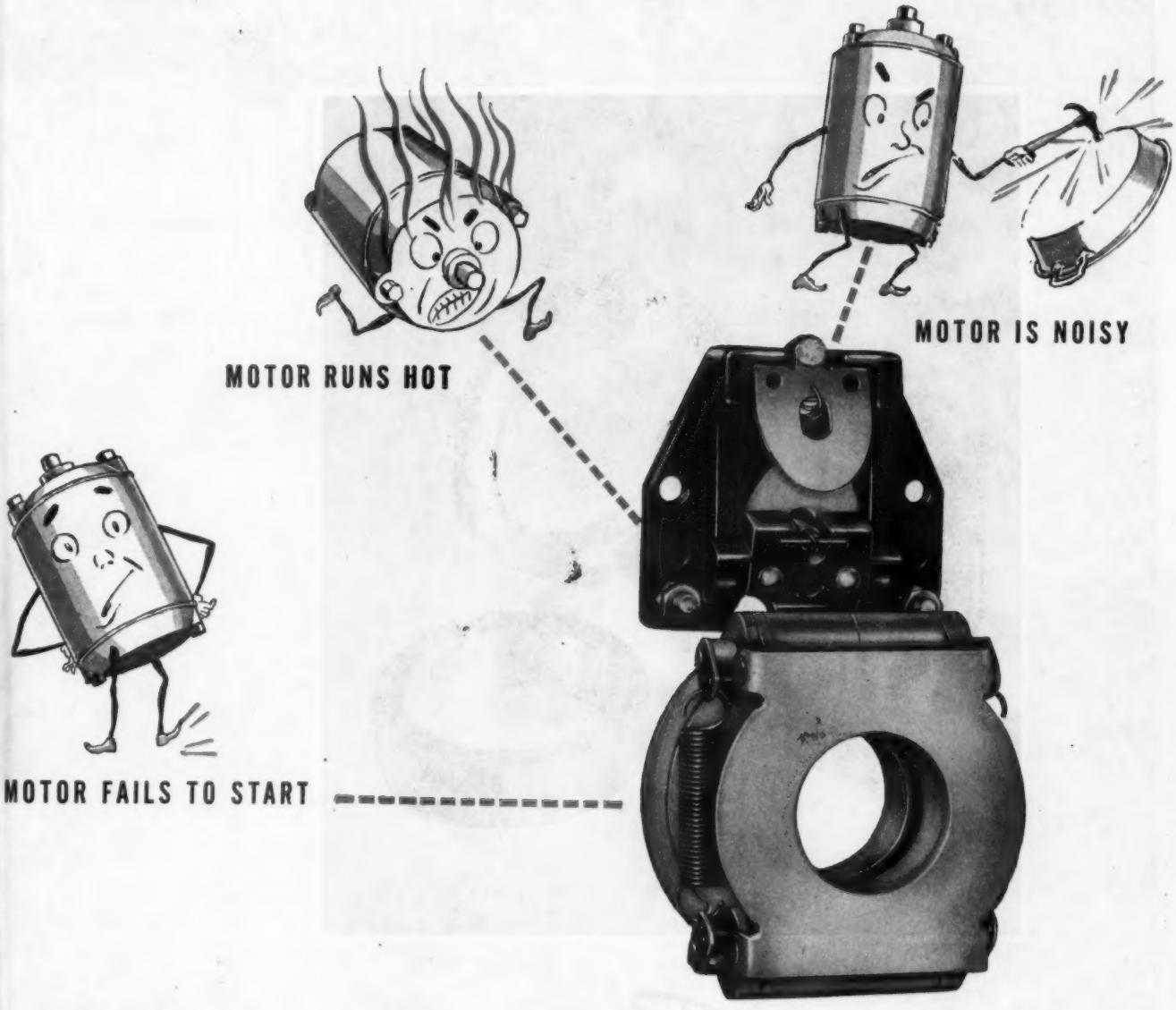

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(*and here's one reason why they won't!*)

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Send for any or all of these booklets, now.

When a motor balks at starting, runs hot, or is excessively noisy, a check-up often reveals that these motor difficulties have the same source—a defective starting switch. Open contacts, switch grounding or failing to transfer from starting to running connection, a switch that rattles or rubs inside the motor—all can produce these symptoms of motor trouble.

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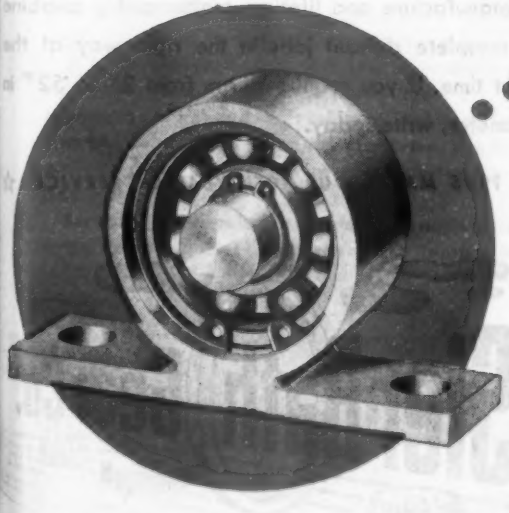
EXTERNAL TYPE NAS-51

INTERNAL TYPE NAS-50



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TO NAIL THIS ZERO!

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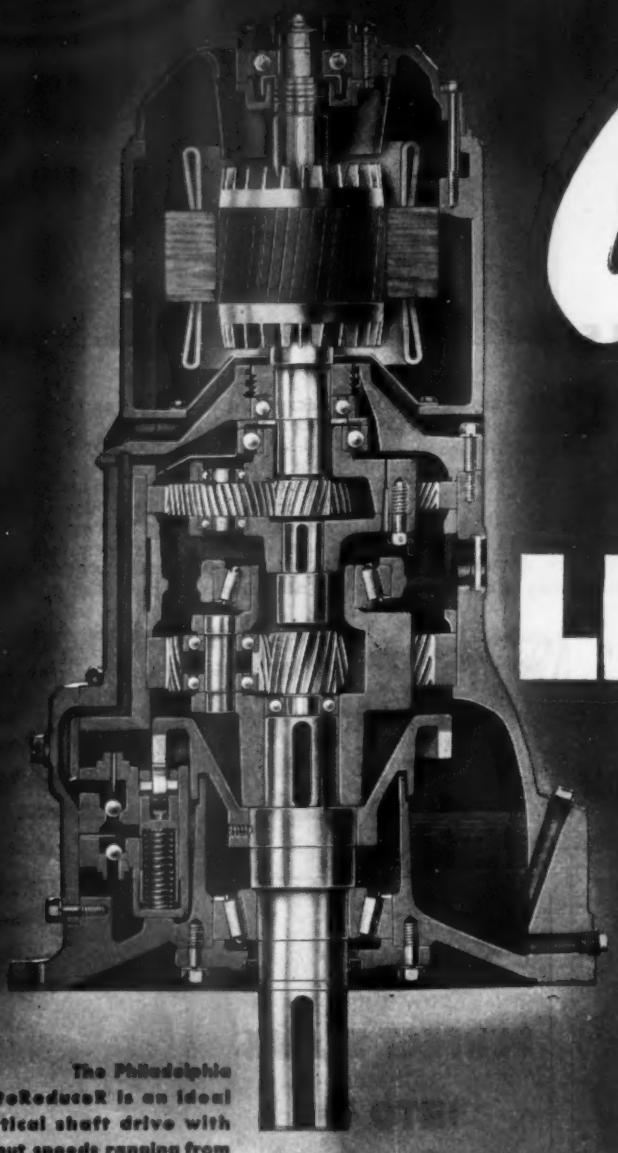

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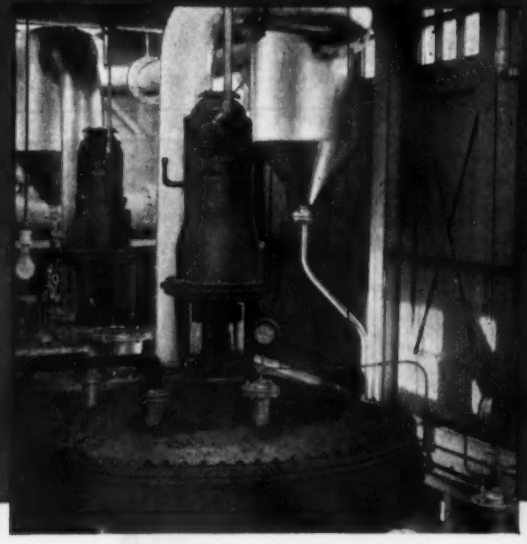
It is compact, since planetary "in line" gearing is built into same housing with motor. The ring type base simplifies mounting design when used on tanks or other machinery.

It is absolutely *leak proof*. The patented oil slinger between the gear housing and motor and the "dry well" construction around the low speed shaft make oil leakage impossible . . . an outstanding advantage for an agitator drive. The large cam-operated plunger pump supplies force feed lubrication to all gears and bearings.

For complete description of horizontal and vertical MotoReduceRs, write on your business letterhead for Catalog MR 40.



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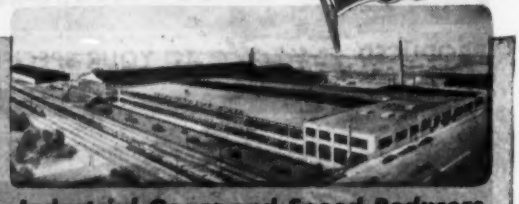
MOTOREDUCER

MotoReduceRs driving autoclave as shown above prevent damage to equipment or product by guarding against oil leakage.



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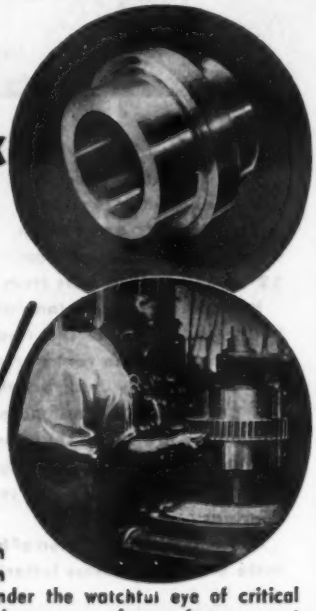

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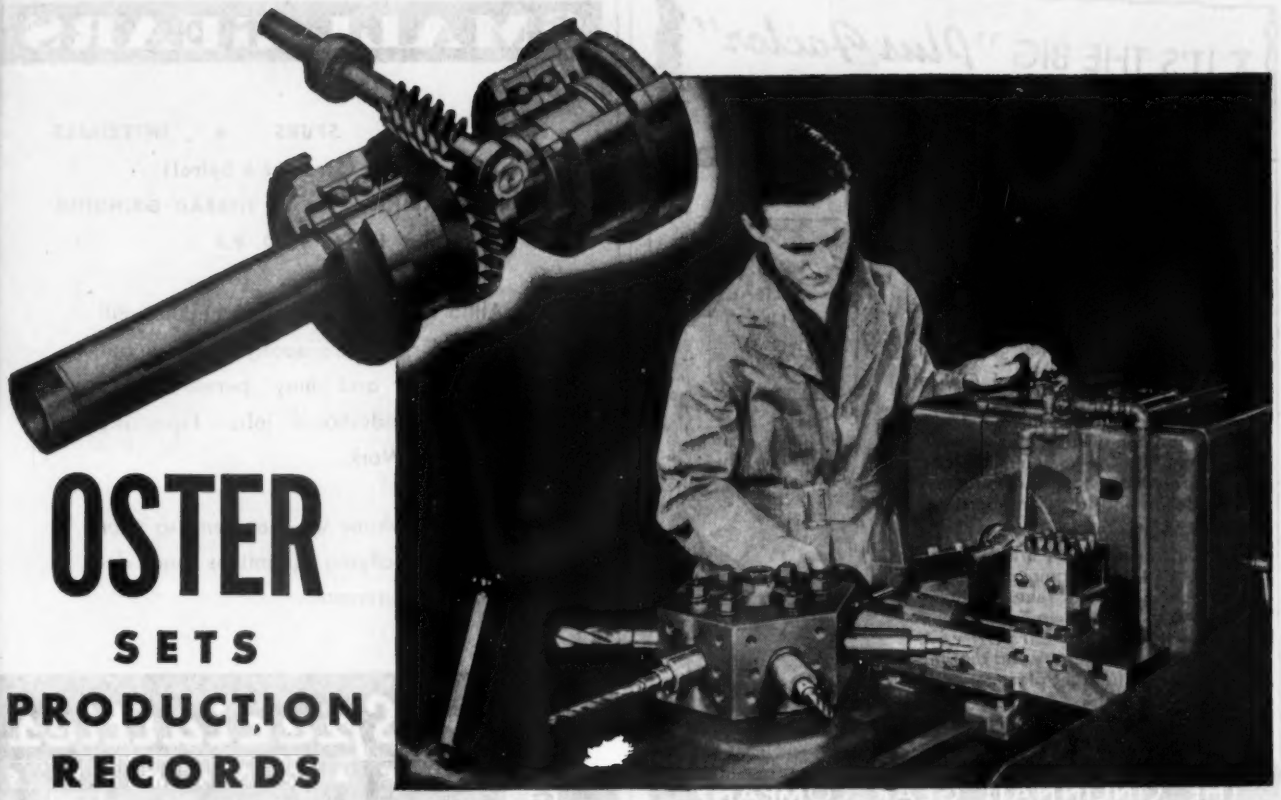

OSTER SETS PRODUCTION RECORDS

...with the help of OHIO GEARS

The improved Oster No. 601 Rapiduction Screw Machine has been setting wholly new records for continuous operation in war production. As an example, in one plant having 139 of these machines, a battery of 67 was operated 24 hours a day, without any stoppage whatever, from Christmas 1943 until June 1944.

Such non-stop performance is a clear indication of the ruggedness and stamina Oster engineers build into the "601". It's a convincing indication too, of the strength, precision and durability of the Ohio Gear worm drive used to operate the spindle. Through it, extremely heavy forming cuts are possible.

Two factors influenced Oster engineers in their selection: 1, the gears stood up to every test; 2, the engineers had had long experience with Ohio Gear products and service in other Oster machines.

Use of Ohio Gear drives in the Oster "601" is another example of the part Ohio Gear products are playing in the development of war and postwar machines.

OHIO GEARS

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Patron Transmission Co.
129 Grand Street

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P. O. Box 995, Pawtucket, R. I.

*LOS ANGELES, CALIF.
J. W. Minder Chain & Gear Co.
927 Santa Fe Avenue

GRAND RAPIDS 8, MICH.
Slaughter Manufacturing Co.
3753 Division Ave. S.

*PITTSBURGH, PA.
Standard Machinists Supply Co.
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322 Curtiss Building

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BUFFALO 16, N. Y.
F. E. Allen
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Kansas City Rubber & Belting Co.
712 Delaware Street

*SAN FRANCISCO, CALIF.
Adam-Hill Co.
244-246 Ninth St.

LOUISVILLE, KY.
Alfred Halliday, 330 Starks Bldg.

INDIANAPOLIS 4, IND.
A. R. Young
635 N. Pennsylvania St.

ST. LOUIS, MO.
St. Louis Tool Co.
2319 N. Ninth Street

THE OHIO GEAR COMPANY
1325 EAST 179th STREET CLEVELAND 10, OHIO

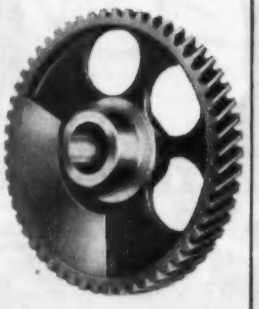
IT'S THE BIG "Plus Factor" THAT COUNTS . . .

OUR work with many manufacturers and designers all over the country has proved the value of close and continuing cooperation with them in developing their gear jobs.

Cincinnati *"Gears, Good Gears Only"*, have built for themselves an enviable reputation in many fields, a reputation for quality, dependability, long life, low maintenance cost and protection against production slow downs and lost man hours.

Of especial importance is the fact that Cincinnati Gears are made to fit your particular requirements, from your specifications. Take advantage of the big "Plus Factor" in Cincinnati *Gears, Good Gears Only* . . . it saves time and money and puts the right gear in the right place.

- ★ SPUR
- ★ BEVEL
- ★ HELICAL
- ★ SPLINE
- ★ WORM
- ★ SPECIAL



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"Gears . . . Good Gears Only"
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SMALL GEARS

HELICALS • SPURS • INTERNALS
BEVELS (Straight & Spiral)
WORM GEARING • THREAD GRINDING
(14 to 96 D. P.)

Altho heavy production schedules still prevail, they are spotty in some departments and may permit us to consider additional jobs — Especially Hobbing Work.

Write or phone us—then *send us your prints* specifying quantities and delivery requirements.

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SPECIALISTS... not jacks of all trades!

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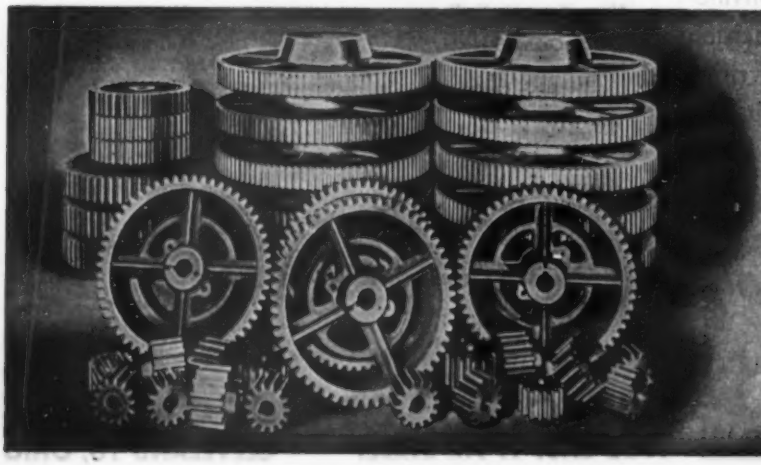
FOR SIXTY YEARS
Spur—SPEED REDUCERS—Worm
ALL TYPES OF CUT GEARS
GANSCHOW GEAR CO., 18 N. Morgan St., Chicago



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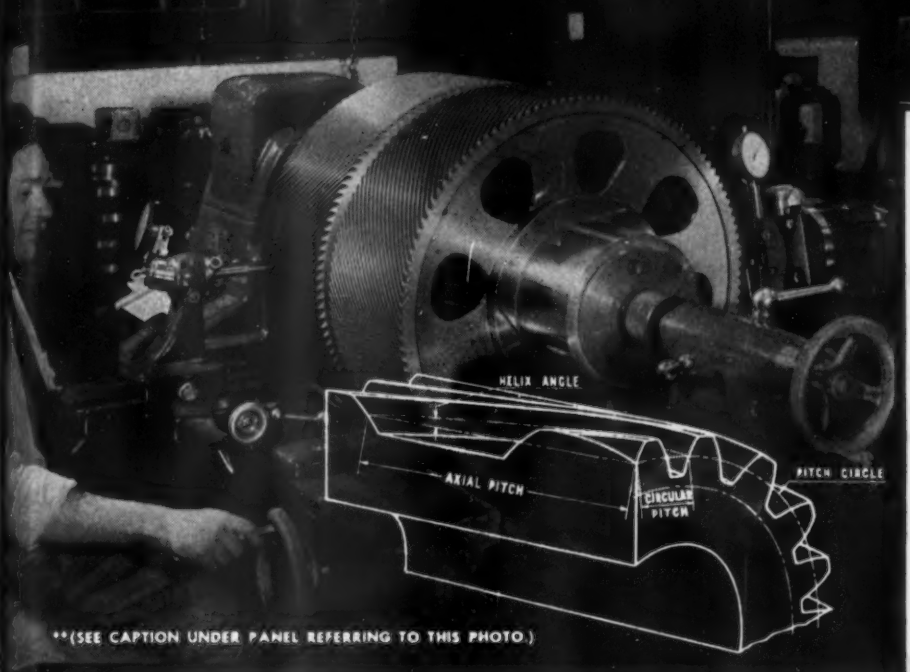
BEVEL — MITER — RACKS
Splined Shafts A Specialty
THE ADAMS COMPANY
Est. 1883
1942 Bridge St. Dubuque, Iowa



**(SEE CAPTION UNDER PANEL REFERRING TO THIS PHOTO.)

Studious Inquiry

at Falk Antedated "Modern Research" by Over 40 Years!

When plastics from resins and magnesium from sea water were only a gleam in the eye of scientists, Falk research was "a going concern."

It was started forty-nine years ago!

Today, more than ever before, Falk is involved in probing structural mysteries through metallurgy and chemical analysis; in tearing apart the "fibers" of metals by mechanical testing; and in delving into the technologies of mechanical power transmission.

All of this studious inquiry was established Falk practice before the phrase "Modern Research" was born!

It is understandable why Falk is a good name in industry.

For by this studious inquiry, Falk has contributed much to the art of its own industry, just as it has to its customers, its community, and its employes, by the maintenance of and adherence to a basically sound, intelligent, and equitable business policy.

It always pays to consult Falk!

* FALK CONTRIBUTIONS

1896 ... The first Falk research was initiated 49 years ago in a Chemical Laboratory devoted to the testing of "ingredients of materials" used in the manufacture of Falk products.

1900 ... Metallurgical research was made a part of the Chemical Laboratory so that "Falk's foundry work included not only its art but also its science."

1905 ... An old Falk catalog refers to Falk research and describes "our own Chemical and Testing Laboratories which enable us to secure a complete record—microscopic, physical, and chemical—of all material used in our furnaces and of the resultant castings."

1906 ... Harold S. Falk, now President, graduated from the University of Wisconsin, the first student of that school to major in metallurgy, stimulating further interest in the importance of research in the field of metal-working.

1910 ... Falk designed and built its own gear hobbing machine in order to manufacture an improved type of herringbone gear which Falk research had proved feasible.

1927 ... An extensive research program of gear performance and capacities was inaugurated. The findings, later presented in an engineering paper, were subsequently found to possess widespread significance.

1929 ... The first research program on the Falk All-Steel Flexible Coupling was started, resulting in improved performance and longer life.

1934 ... The research on gear performance and capacities, started in 1927, was brought to a conclusion and culminated in the Schmitter Rational Gear Formula, now accepted by the industry as the basis for gear design and rating.

1935 ... Further research on Falk Couplings resulted in a coupling that is unique both from the design and long, trouble-free service standpoint.

1938 ... Research was carried on which led to the famous Falk Marine Reverse Drive used in army cargo boats, tugs, navy barges, and exclusively in LST's.

TODAY ... Gruelling tests in which couplings are being operated under severe misalignment, and gear tests at speed step-ups as high as 30,000 revolutions per minute are now in progress.

** Falk technicians are never satisfied that they have reached the ultimate. Here, in this photograph, the helical lead of a turbine reduction gear is being checked on a lead checking machine.

THE FALK CORPORATION, MILWAUKEE 8 WISCONSIN

For over fifty years precision manufacturers of Speed Reducers ... Motoreducers ... Flexible Couplings ... Herringbone and Single Helical Gears ... Heavy Gear Drives ... Marine Turbine and Diesel Gear Drives and Clutches ... Contract Welding and Machine Work. • District Offices, Representatives, or Distributors in principal cities.

IT ALWAYS PAYS TO CONSULT **FALK** ... A GOOD NAME IN INDUSTRY

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"When your specifications call for special gears — Spur — Bevel — Mitres — Helical — Worms and Worm Gears — Reduction Units — Why not try GRANT.

You will find GRANT service meeting all requirements of both stock and special gears."

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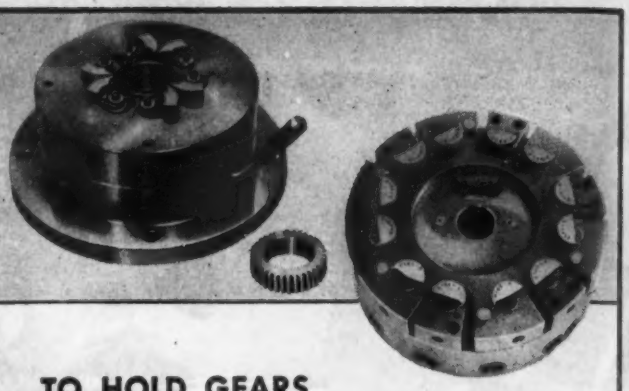
BOSTON, MASS.



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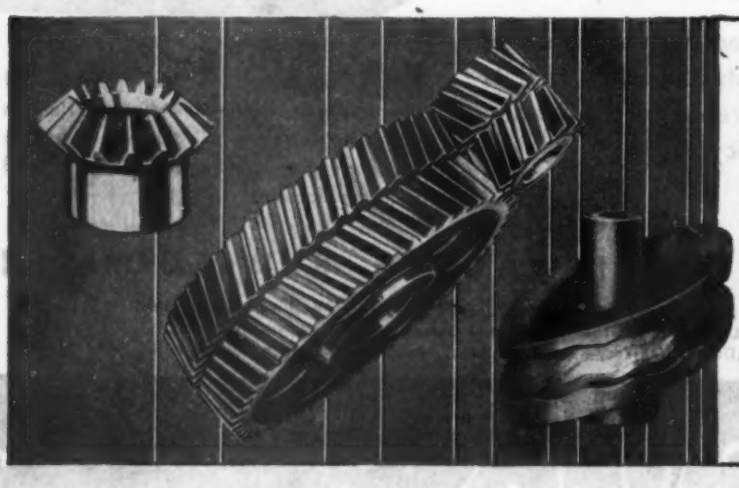

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Send blue prints or samples for estimate. Accuracy of work guaranteed to your specifications.

THE HARTFORD SPECIAL MACHINERY COMPANY
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MITER GEAR UNITS

Boston Gear Standard miter gear units provide an efficient and compact means of transmitting motion at the same speed through right angles (around corners) and are furnished in sizes to convey 3/4 to 12 horsepower at 1200 R.P.M. Further, they can be supplied with the shaft projection vertically up or down or horizontally on three sides and, in addition, the base can be assembled on the unit for ceiling, side wall or horizontal mounting. These miter gear units are oil tight, they are equipped with case hardened steel spiral miter gears, and all shafts are mounted on ball bearings.

Any of the following authorized distributors and direct company branches will be pleased to give you complete specifications and prices of these Boston Gear Standard miter gear units:

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ALBANY, NEW YORK
Sager-Spuck Supply Co., Inc.
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Kester Machinery Co.
CANTON, OHIO
Manufacturers Rubber & Supply Company
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Mathews-Morse Sales Co.
CHICAGO, ILLINOIS
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Boston Gear Works, Inc. (Branch)
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Power Transmission Equipment Company
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Bronx Hardware & Supply Co.
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C. W. Marwedel
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Illinois Bearing Co.
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you can reduce die costs and assembly time with JESSOP

Sheet metal dies made from Jessop Composite Die Section Material.

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With the use of Jessop Composite Die Section Material, blanking or cutting dies can be made at a lower cost, saving from 28% to 47% over the cost of the same dies made from rectangular bar stock.

The cutting edge of Jessop Composite Die Section Material is electric furnace water-hardening tool steel, backed by a tough, non-hardenable steel. When Jessop Composite Die Section Material is used, there is no necessity for machining to shape because it is rolled to shape. Slow and expensive hand lapping is eliminated and dowel holes may be drilled after hardening.

Jessop Composite Die Section Material is recommended for straight die sections and for slightly bent sections.

Eight different shapes are available in lengths of 8 to 10 feet. Applications include airplane sheet metal dies, auto body dies, truck body dies, railroad car dies, metal container dies, and any application in which sheet metals are to be cut to regular or irregular shapes.

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Head Office and Works

Washington . . . Pa.

Established 1901

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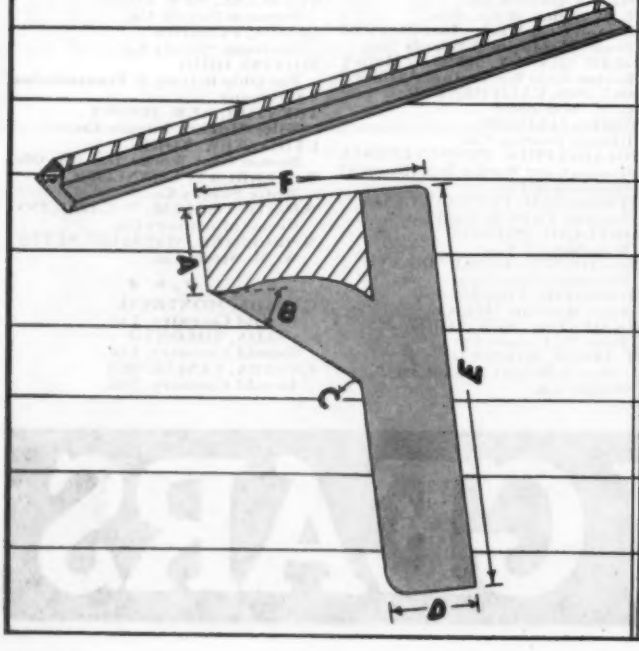

Sec. No.	A	B	C	D	E	F	Weight
D	15/32	30°	1/4R	29/32	2 1/16	1 3/8	7.25 lbs.
AA	63/64	30°	1/4R	1 1/16	3 1/16	1 9/16	12.5 lbs.
A	31/64	30°	1/4R	1 1/16	2 9/16	1 9/16	10.83 lbs.
SS	63/64	30°	1/4R	1 1/16	3 3/16	1 15/16	14 lbs.
B	31/64	30°	1/4R	1 1/16	3 9/16	2 1/16	15.6 lbs.
BB	63/64	30°	1/4R	1 1/16	4 1/16	2 1/16	18.44 lbs.
C	31/64	30°	1/4R	1 1/16	4 1/16	2 5/8	19.3 lbs.
CC	63/64	30°	1/4R	1 1/16	4 9/16	2 11/16	23.94 lbs.

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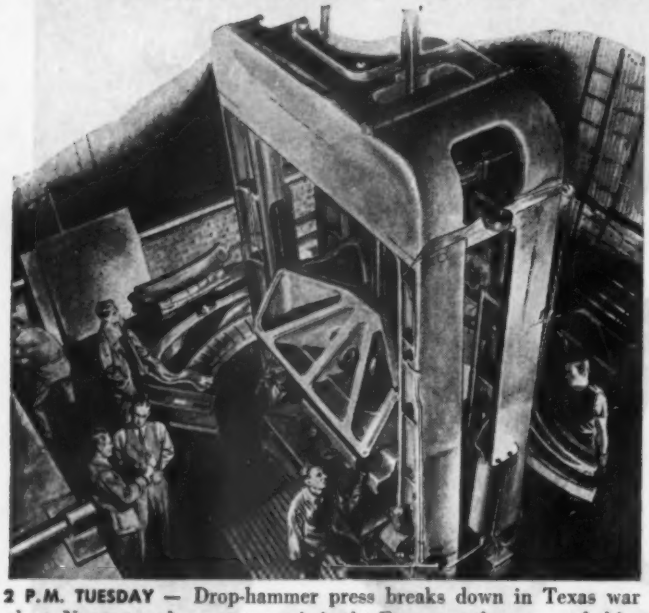

2 P.M. TUESDAY — Drop-hammer press breaks down in Texas war plant. Nearest replacement part is in the East, over three normal shipping days away. To avoid costly shutdown, the manager telephones for a new part via Air Express, even though the part weighs 250 pounds.

7 A.M. WEDNESDAY — Replacement part lands at Texas airport. Air Express charges were $180. But manager figures a saving to the plant of three precious production days and a saving of $2,000 in overhead by avoiding a shutdown.

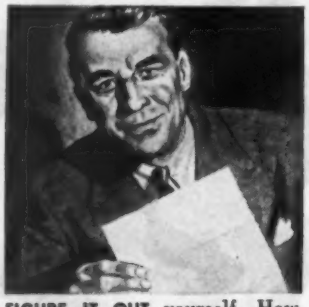

FIGURE IT OUT yourself. How much would it cost you per day if your business — or a part of it — came to a standstill for lack of essential parts or material? Remember, the nation's inventory is within hours of your door, via Air Express.

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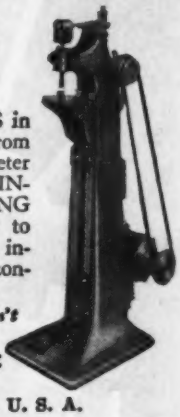

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AUTOMATIC EQUIPMENT
The V & O Press Company, Incorporated
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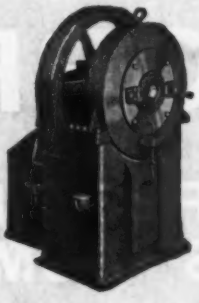

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TORRINGTON
ROTARY
SWAGING MACHINE

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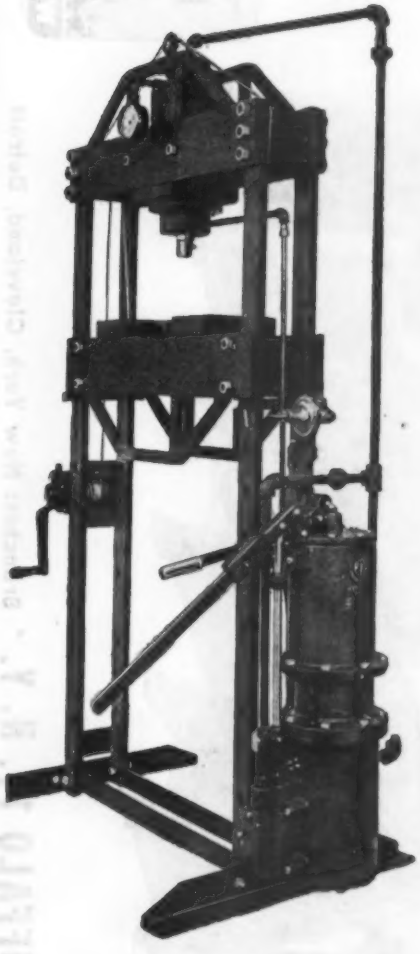
These smaller size Niagara Inclinable Presses offer the same design features of larger Niagara Models. The instant acting 14-point sleeve clutch is an important factor in increasing the output per man hour. It is possible that one or more of these presses can help you in speeding up production of urgently needed wartime material.

THE MIGHTY 7th WAR LOAN

NIAGARA MACHINE & TOOL WORKS, BUFFALO 11, N. Y. · Branches: New York, Cleveland, Detroit

Adaptable to any job.



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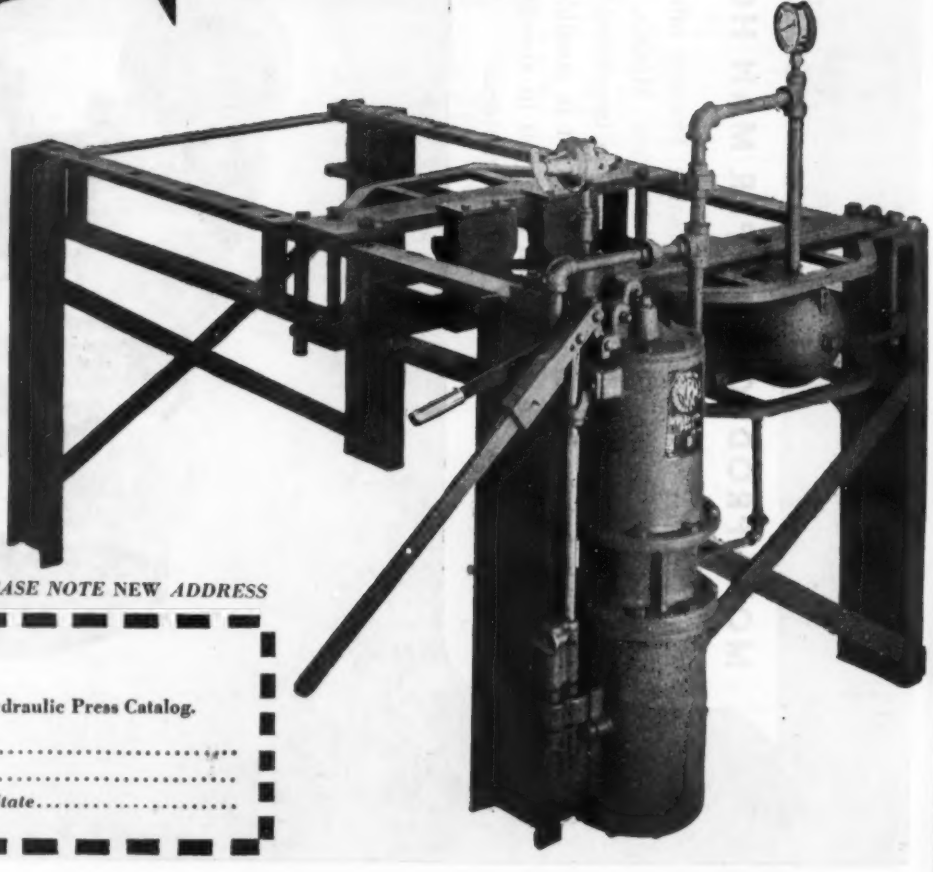

HORIZONTAL OPERATION

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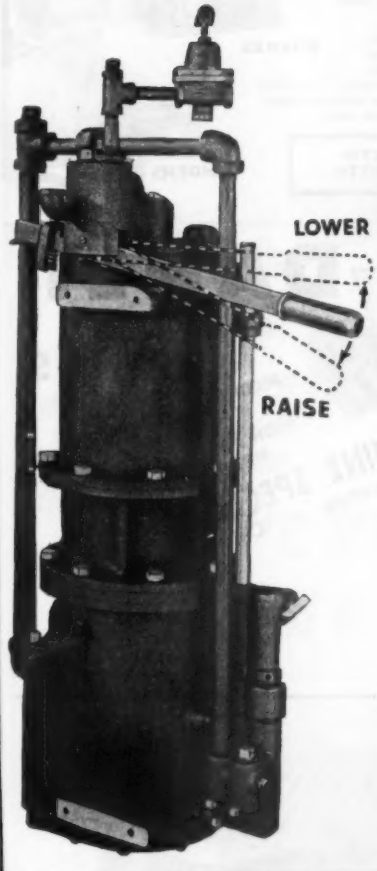
these Low-Cost KRW

HYDRAULIC ARBOR PRESSES SAVE TIME, SPACE AND MONEY



THE KRW *Speedi-Booster*

THE REASON WHY KRW PRESSES ARE FAST AND ACCURATE. The KRW Speedi-Booster eliminates the need for the conventional Capstan wheel or pumping lever. Instead, it uses compressed air as the motive power operating the ram. Because the compressed air is controllable through a pressure regulator, any desired tonnage pressure at the ram can be obtained and duplicated. Ram movement (up, down or stop) is instantly controlled with the slightest fingertip movement of the lever.

ADAPTED AS A LOW-COST FORMING BRAKE

AVAILABLE TONNAGE PRESSURES
25-50-60 TON PRESSES

AIR PRESSURE	7" AIR CYLINDER		9" AIR CYLINDER	
	2" Oil Cylinder	1¾" Oil Cylinder	2" Oil Cylinder	1¾" Oil Cylinder
100 TO 200 POUNDS	10 to 22 Tons	14 to 29 Tons	17 to 35 Tons	23 to 47 Tons

75 TON PRESS

AIR PRESSURE	9" AIR CYLINDER	
	2" Oil Cylinder	1¾" Oil Cylinder
100 TO 200 POUNDS	25 to 51 Tons	33 to 68 Tons

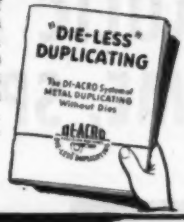
Write Today for the KRW HYDRAULIC PRESS CATALOG

K. R. WILSON
BUFFALO 3, NEW YORK

PLEASE NOTE NEW ADDRESS

Metal Stampings
"DUPLICATED WITHOUT DIES"

If you desire to save time and critical materials on production of metal stampings or other small parts, then the DI-ACRO System of "Metal Duplicating Without Dies" merits your consideration. It is based on the rapid and accurate production of formed parts with DI-ACRO Shears, Brakes and Benders. All duplicated work is accurate to .001". These precision machines are adaptable to an endless variety of work, and ideally suited for use by girl operators. For short runs your parts are processed in a matter of hours instead of waiting weeks for dies.



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"DIE-LESS DUPLICATING"
It illustrates many stampings or parts made without dies, gives full details on DI-ACRO machines and shows how they may readily be adapted for various applications. Request your copy now.

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FASTER HAND OR PRESS STAMPING

12 characters, more or less, stamped at one blow. Press the thumb clip and quickly change type or dies for next markings. No weakening groove in type. Heavy Duty Type with "Extra Strength Shoulder" stamps any untempered steel, or other material. Ask for HERCULES HOLDER & TYPE.

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MEDIUM PRESSURE HIGH DEFLECTION
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For Faster, Better Contour Grinding

Boyar-Schultz No. 1 Profile Grinder eliminates much of the slow, tedious hand work in fitting dies and punches, grinding die clearances and grinding odd, irregular shapes encountered in making cams and templates.

The high spindle speed of 20,000 R. P. M. removes stock efficiently, even when small diameter wheels are used.

New large, serrated top table permits smooth movement of work and grinding to closer tolerances.

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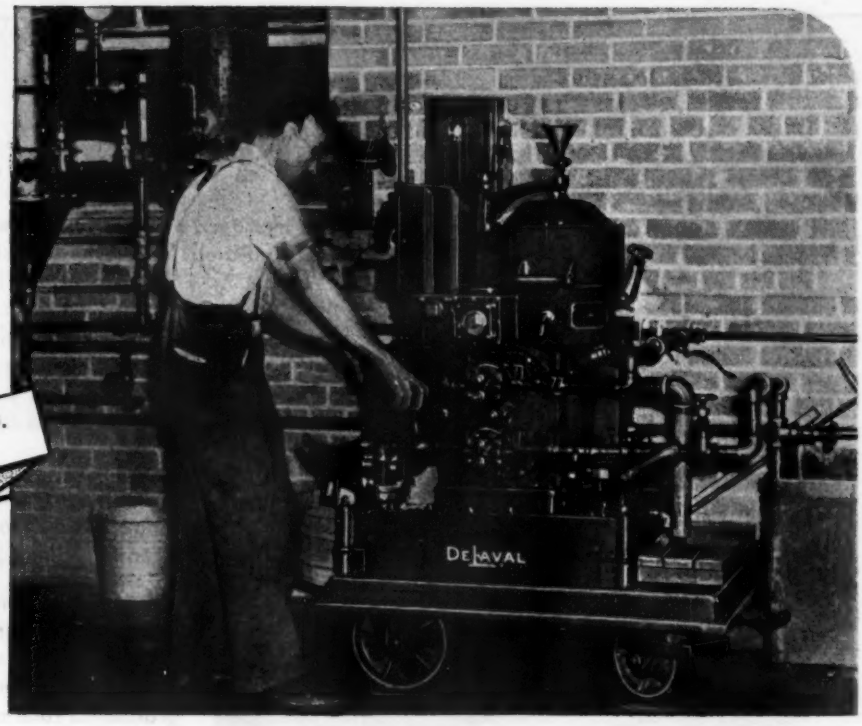
DE LAVAL "UNI-MATIC" OIL PURIFIER IN USE AT NEW CHIP HOUSE AT TORONTO PLANT.



AT JOHN INGLIS COMPANY LTD. TORONTO, CANADA

De Laval

CUTTING OIL PURIFICATION PAYS $3,400 PER MONTH...

RECLAMATION and maintenance of cutting oil by means of a De Laval "Uni-Matic" Oil Purifier pays over $3,400 per month to the Toronto plant of the John Inglis Company, Ltd. At this leading Canadian producer of small arms, the De Laval centrifuge removes water and the finer metallic particles from more than 10,000 gallons of cutting oil per month, enabling it to be used over and over again. In fact, the De Laval centrifuge restores the oil to a degree of purity most nearly identical with that of new oil.

Corresponding savings can be realized even when plants are not as large as that of the John Inglis Company, Ltd. There are De Laval Oil Purifiers and De Laval Chip Oil Extractors available to meet practically every capacity requirement. Thus every machine shop can, by means of De Laval centrifugal equipment, maintain its cutting oil to best advantage, and obtain such benefits as longer tool life, higher cutting speeds and lower oil consumption.

• Write for Bulletin FC-5.

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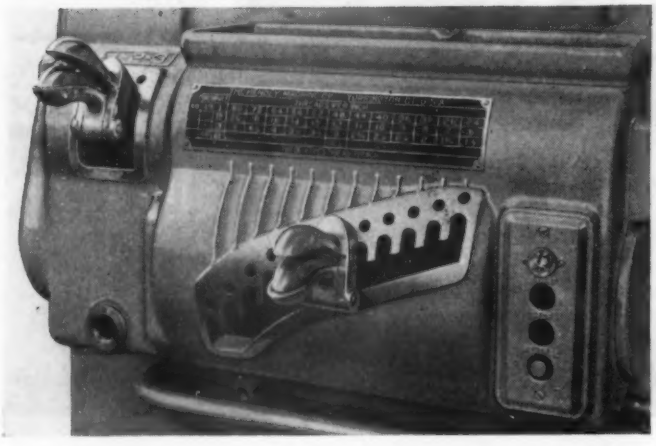
DE LAVAL

PURIFIERS and CLARIFIERS for FACTORY OILS

FOR GREATER OPERATING EFFICIENCY

Hendey **LATHES *pioneered with***

the use of improved thread cutting mechanisms. In 1892 (53 years ago) Hendey Lathes incorporated the Norton Quick Change Gear Box which provided for twelve different leads or pitches of thread without gear change. This major feature in thread cutting, combined with an automatic stop for length of carriage travel plus a feed reversing control from the lathe apron, improved and increased the thread cutting productive capacity of Hendey Lathes many fold.



The modernized version of the original Norton Quick Change Gear Box as applied to Hendey 18-speed geared head precision tool room lathes.

(An auxiliary 3-speed gear box, coupled in later years to the original Norton gear box, increased the thread cutting range of the gear box mechanism from 12 to 36 different threads without gear change.)

Two other important mechanical features which increase the thread cutting range of Hendey Lathes are: the Sub-Headstock, especially valuable for coarse leads beyond the 1½ per inch on regular index plate; and the graduated face of spindle collar, whereby through the use of the slip gear (found on all Hendey lathe heads) being disengaged from the train of gears to gear box, multiple threads may be cut, such as 2-4-6-8.

●

A contemporary improvement with the thread cutting mechanism came in the form of precision cut lead screws to be supplied on order with these improved lathes. This development in lead screw precision was steadily carried on by Hendey through the ensuing years, with the result that for many years past, fine tool and instrument makers have come to Hendey with their thread cutting problems for a satisfactory solving. This engineering service has likewise covered the necessity of cutting many threads with odd pitches, so that within the primary range of 1½ to 80 threads per inch intermediate threads almost without limit have been made available to users of Hendey Lathes.

●

1874

71 years devoted to the creating of machine tools of quality demanded by critical users who have always wanted the best.

1945

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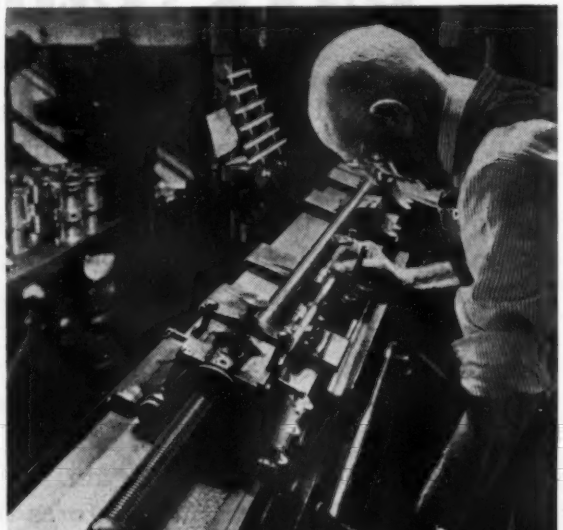

Testing Hendey lathe leadscrew for accuracy of lead.

THE HENDEY MACHINE CO.

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Here's Help FOR YOUR TOOL ROOM

The New COVEL
CUTTER & TOOL GRINDING MANUAL

A time-and-money saving factual aid for new hands in the toolroom—and for seasoned veterans, too! A 128-page book that takes you through every step in setting up all types of milling cutters for grinding; that explains in graphic detail the use of various accessories on cutter and tool grinders;—covers thoroughly the operation and use of a cutter and tool grinder;—gives practical help in choosing the right grinding wheel for every job . . . Plus page after page of grinding tips and short cuts that will mean added savings in time and manpower for you. And there's a whole section of tables and charts, arranged for handy reference, to cut down pencil and guess work. Write your name and position on your company letterhead, and send it to us for a free copy of this new Covel Manual, "Universal Cutter and Tool Grinding"—A regular $1.00 value—but it's *free* to you toolroom and production men. Write for "Handbook

This is just another example of Covel Service to industry. Since 1874, manufacturers have been bringing their grinding problems to Covel, with complete satisfaction. This company now offers a complete line of Cutter and Tool Grinders, Drill Grinders and small Surface Grinders. Let Covel experience show you what can be done to improve production and cut costs in your toolroom.

A-1356

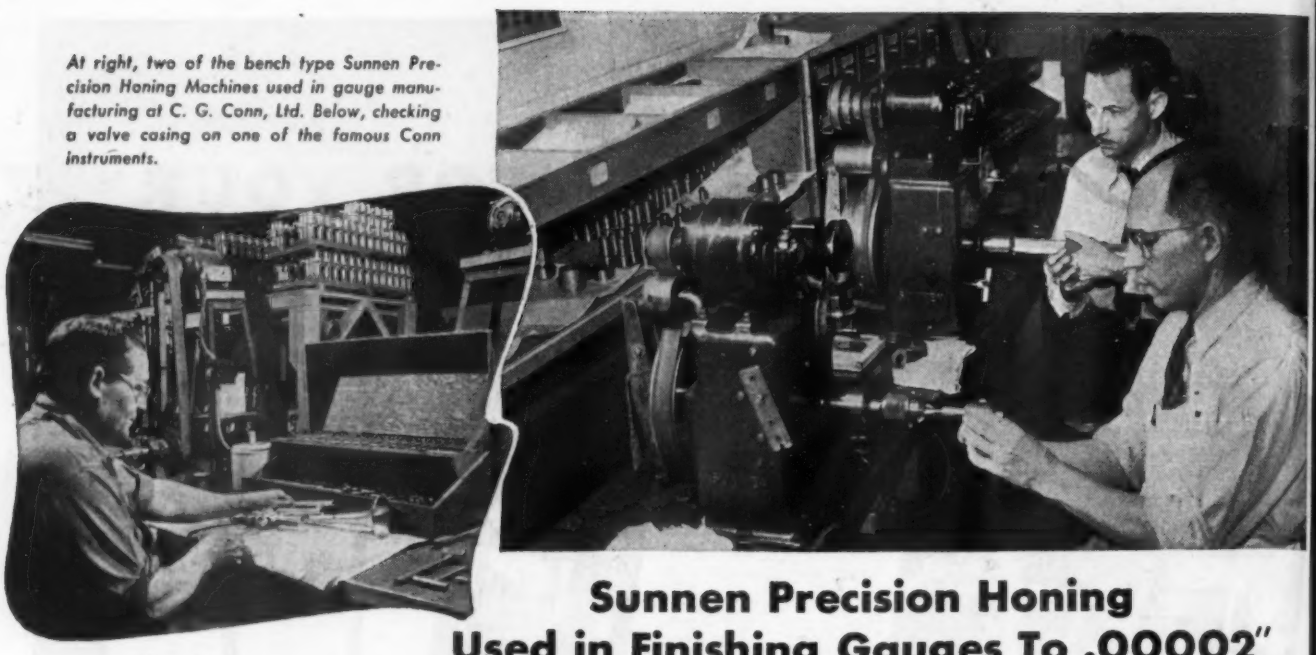
Covel No. 12 Cutter and Tool Grinder

GRINDING MACHINERY SINCE 1874

COVEL INDUSTRIAL GRINDERS

COVEL MFG. CO., BENTON HARBOR, MICHIGAN U. S. A.

At right, two of the bench type Sunnen Precision Honing Machines used in gauge manufacturing at C. G. Conn, Ltd. Below, checking a valve casing on one of the famous Conn instruments.



Sunnen Precision Honing Used in Finishing Gauges To .00002" at C. G. Conn Ltd.

On valve casing gauges, used in making the famous Conn musical instruments, the Sunnen Precision Honing Machine is being used to obtain a tolerance of .00002" in high-grade tool steel — about 65 Rockwell. Gauges are honed to within .0001" of finished size, and then lapped to final finish. Not only do they get a better job, are more positive in their results, but they save a great amount of time over the previous method — lapping all the way from grind to finish size.

Here's a real precision job that is helping Conn to produce a limited supply of musical instruments to sustain the morale of the boys in service, and a larger supply of aircraft and marine navigation instruments, electronic testing equipment, silver-coated aircraft bearings, etc., to sustain them in battle.

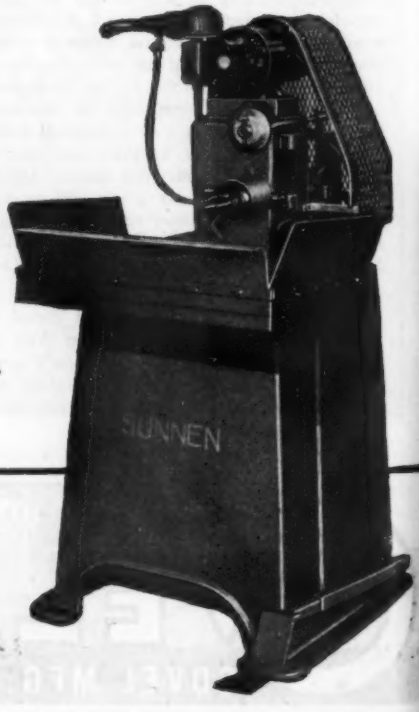
It may be that the Sunnen Precision Honing Machine can do the same kind of internal honing and finishing job for you. It will hone any surface from .185" to 2.625" in diameter—in any metal or plastic except lead and babbitt — produce a super-smooth finish — with a *guaranteed* accuracy of .0001" — accurately duplicate sizes—without jigs or fixtures—can be set up in one minute—and does not require skilled labor.

Bring your internal finishing problems to the attention of a Sunnen engineer. He will show you how these advantages can be applied to your problems — or write for complete information.

When you ask about the Sunnen Precision Hone, be sure to find out about the recent improvements—including the new coolant pump and base assembly that furnishes a steady stream of honing fluid to the work. There's also a new machine light that makes inspection and gauging of parts easier.

These improvements can be added to bench model machines now in use, if desired.

The coveted Army-Navy "E" waves over the Sunnen plant — evidence of the important part Sunnen equipment is playing in the war effort.

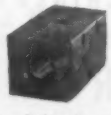


SUNNEN

SUNNEN PRODUCTS COMPANY, 7941 Manchester Ave., St. Louis 17, Mo.
Canadian Factory: Chatham, Ontario

Typical Jobs

Compressor Yoke. Alignment maintained and better finish produced.

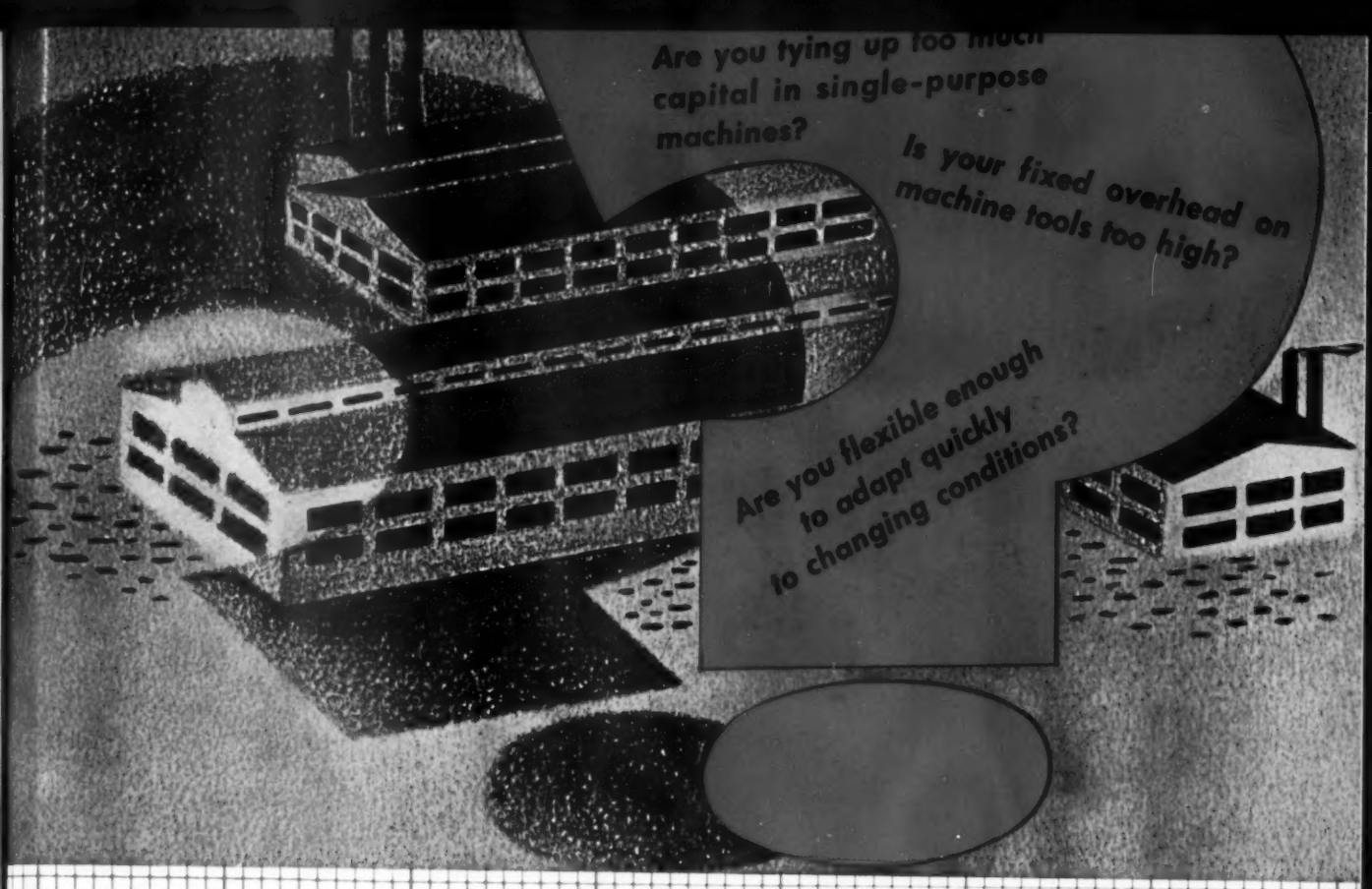


Saved time in producing a smooth accurate finish on this bronze remote control valve body.

Automobile Distributor Shaft Gears. Taper removed at a rate of 80-90 per hour.

Aircraft Hydraulic Brake Cylinder. Honing 3 times faster than lapping — and gave a straighter hole.

Roller Bearing Outer Race. Finish improved from 12 micro-inches to 2 micro-inches.


Are you tying up too much capital in single-purpose machines?
Is your fixed overhead on machine tools too high?
Are you flexible enough to adapt quickly to changing conditions?

Cut Your Investment RISK in Post-War Retooling

with this practical approach to the uncertainties that lie ahead . . .

Tool up with flexible, low-cost

Delta-Milwaukee Machine Tools

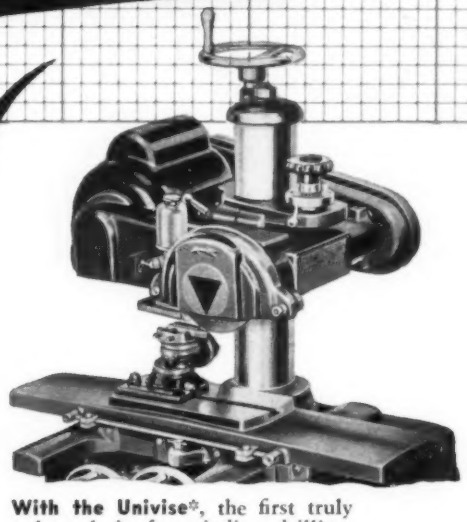
HERE ARE THE MACHINES

You can extend the savings of DELTA-MILWAUKEE MACHINE TOOLS *to almost every department*

yet .n
War p

Delta Toolmaker Surface Grinder

Low cost and portability permit this husky, big-capacity grinder to be quickly swung into any spot to free machines costing many times as much. Designed for ease and speed of surface grinding, tool sharpening, and any grinding operations within its range. Convenient controls . . . wide graduations on micrometer for close settings . . . unique wheel-adapter that saves time on truing-up operations . . . many other advantages that help assure you of creditable performance. 7" x ½" wheel; 1¼" bore. Table surface 5¾" x 13"



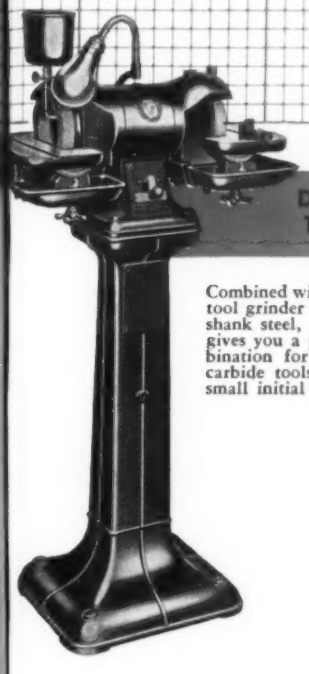
With the Univise*, the first truly universal vise for grinding, drilling, and milling — and the coolant attachment — this machine serves as a dependable, accurate Chip-Breaker Grinder for grinding the chip-breaker groove on carbide-tipped tools. Holds the tool at any conceivable angle — accurately reset at a moment's notice.

With the Unihead*, and the tool and cutter grinder attachment, this machine becomes the latest development in Tool and Cutter grinding. Simple, accurate, very low in cost. Delta construction features assure perfect alignment and freedom from play. Substantially built and machined to very close tolerances.

Consult your **DELTA-MILWAUKEE** *distributor regarding*

.maintain volume and quality

production experience proves it!



Delta Carbide Tool Grinder

Combined with the Delta standard tool grinder for hogging down the shank steel, this vibrationless unit gives you a perfect working combination for sharpening tungsten carbide tools, with a remarkably small initial investment.

Delta Grinder with Twin-Lite* Safety Shields

Safety glass shields are built right in! Both wheels are flooded with light, to assist accurate tool grinding. Easily-adjustable, machined tool rests. Balanced wheels.

NEW!

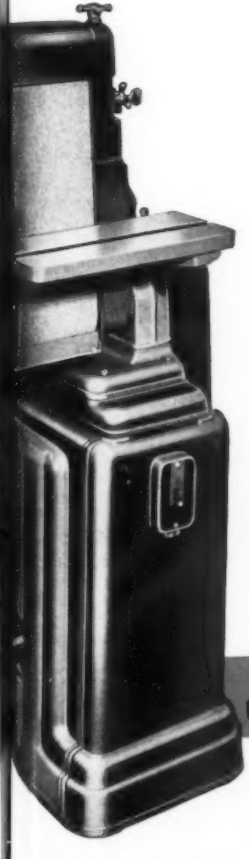
Delta Super-Hi-Speed Drill Press

A low-cost 14″ machine for precision small-hole drilling of plastics and light non-ferrous metals. Interchangeable with standard Delta 14″ model on regular 14″ drill press column. Speed range of 12000 . . . 8100 . . . 5000 R.P.M. Specially-selected Jacobs chuck with drill capacity of from .025″ to ¼″. Spindle travel of 2¼″. Head, complete with 60-cycle motor, available separately.

Write for free, descriptive bulletin.

Delta 14″ Metal-Cutting Band Saw

Saves time and money on many general tool and machine shop operations — sawing off tool, die, and fixture stock; cutting templates and similar tools; cutting almost any material from carbon steel to asbestos. Fully safeguarded.



Delta 6″ Abrasive Belt Finishing Machine

Reduces cost per unit for precision finishing, polishing, edging, burring of small parts. Completely flexible in operation — can be set vertically or horizontally. Has lubricated-for-life ball bearings and other famous Delta quality features.

Famous Delta quality features help assure dependable, low-cost performance

1. **Lubricated-for-life New Departure ball bearings** double sealed against abrasive shop dust.
2. **Pre-loaded** bearings with unnecessary play between balls and races eliminated.
3. **Precision-bored bearing seats** that help keep shafts accurately aligned.
4. **Balanced pulleys** prevent the transmission of belt vibration to spindle.
5. **Precision-ground shafts** run true, smoothly, and without vibration.

priorities and deliveries

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Machine Tools

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Delta Floor-Type Multiple-Spindle Drill Presses

4-spindle model illustrated. 2-spindle model also available with one-piece table. Floor types with sectional tables: 3-, 4-, 5-, 6-, and 8-spindle models.

Delta Power-Feed Drill Presses

Worm-driven power feed gives 8 rates of feed for each spindle speed. Instantly switched to sensitive hand drilling.

17-inch single-spindle drill presses available in 24 different models.

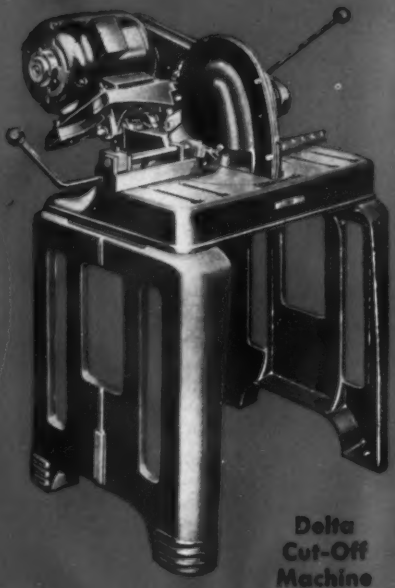
Delta 14" Floor-Type Drill Press

Patented construction provides *both* a self-aligning drive and a free-floating spindle. Features include smooth-working table-raising mechanism, built-in depth gauge, safety belt guard, etc.

FREE 76-PAGE BLUE BOOK

helps you more clearly visualize — and utilize — the versatility of Delta-Milwaukee Machine Tools

This book of stimulating tooling ideas gives you 140 case histories of valuable war production experience that may suggest similar money-saving peacetime applications of Delta-Milwaukee Machine Tools in your plant. • It shows how you can — as others have done — use regular stock-model Delta elements to build special-purpose machines that can be quickly converted to other uses when requirements change . . . or modernize obsolete machines, by replacing worn units with standard Delta components . . . or use low-cost Delta tools to quickly revise production-line layouts to get the best sequence of operations for increased man-hour output. • This modern way of retooling is practical, because your capital investment is held to a minimum. Delta cost savings are due to modern production methods applied to a large volume of standard models — not to short-cuts in quality. • Also available is a catalog of Delta-Milwaukee Machine Tools. Send for both books. Use coupon below.



Delta Cut-Off Machine

Eliminates expensive finishing. Available at a fraction of the usual cost for machines of this type. Three models — with abrasive wheel, for cutting steel; with steel blade, for cutting plastics and non-ferrous metals with polished smoothness; with cross-cut blade, for cutting wood.

Tear out coupon and mail today!

THE DELTA MANUFACTURING CO.
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Please send my free copy of the 76-page Blue Book and catalog of low-cost Delta-Milwaukee Machine Tools.

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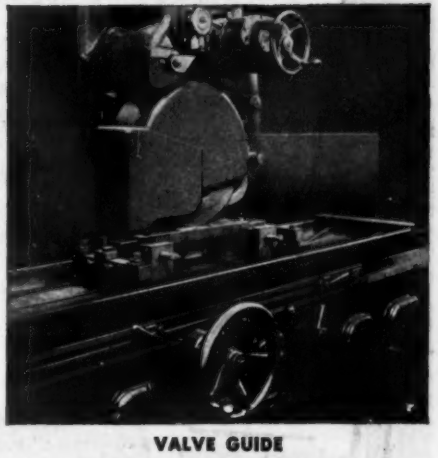
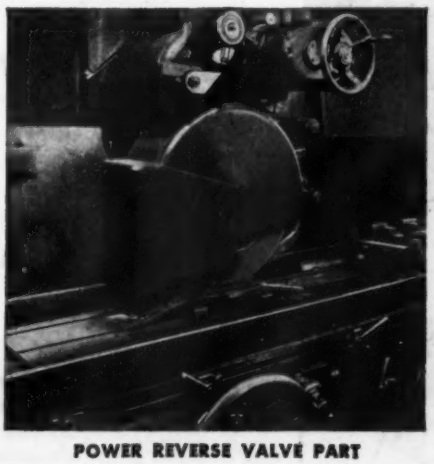
THESE are only a few of the many jobs which Mattison High Powered Precision Surface Grinders are capable of handling for railroad shops. Its rugged construction and large vertical and horizontal capacity makes it possible to grind one large part or many small parts. In all sizes from 12″ to 36″ wide, 36″ to 192″ long Mattison Grinders are built to do high powered, precision grinding, saving time and maintaining accuracy. Send for free circular containing complete information.



VALVE GUIDE

ADDITIONAL INFORMATION

Also available is free SET-UP Book showing further examples of work ground on Mattison Grinders. Send for copy today.



POWER REVERSE VALVE PART

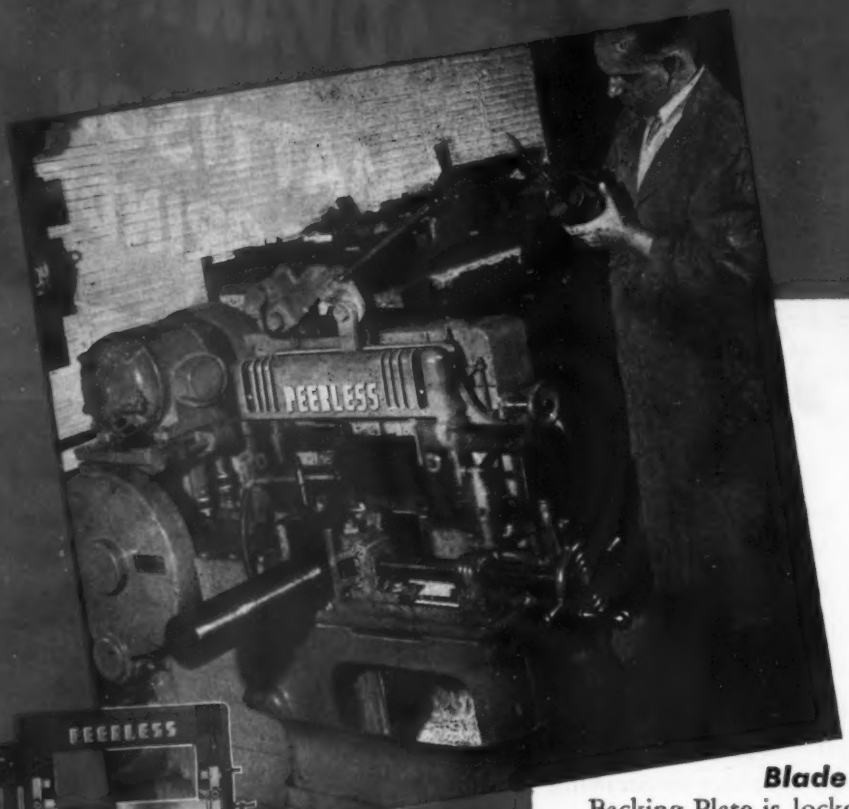
POWER REVERSE GUIDE

MATTISON MACHINE WORKS

ROCKFORD · ILLINOIS

FASTER METAL SAWING WITH ★ ★ ★ PEERLESS

Fingertip control of feed pressure to fraction of a pound is provided. Mechani-Cut is made in 4" x 7", 11" x 11", and 14" x 14" capacities.



7" x 7" Peerless Mechani-Cut in use at National Service Company, Milwaukee.

Only Peerless Metal Sawing Machines have the Four-Sided Saw-Frame.

Peerless Hydra-Cut Power Hydraulic Metal Saws. Full hydraulic control is provided. 33⅓% more cutting speed! 25% longer sustained accuracy! 75% more coolant capacity! Capacities, 7" x 7", 11" x 11", 14" x 14". Convertible to automatic bar feed.

Amazingly straight, fast sawing to close tolerances is accomplished with the new, mechanically-driven *Peerless Mechani-Cut* and at new low costs! Each part of the *Mechani-Cut* is precision-built and assembled by craftsmen. Smooth, straight cutting is assured by the Four-Sided Saw-Frame which completely surrounds the blade and the work. The Saw-Frame reciprocates on hardened and ground ways.

Blade Backing Plate

Backing Plate is locked 1/32" above saw blade, allowing extremely heavy cutting pressures and assuring blade clearance. Blade clears on every return stroke, decreasing breakage and increasing blade life.

Fingertip Feed Pressure Control

Within easy reach of operator and away from chips and coolant spray, the Compensating Feed Unit enables accurate pressure control. Highly sensitive rack and pinion feed compensates for hard spots in metal and for varying shapes, sizes, and types of stock.

You Can Cut Metals Faster And At Lower Cost With Peerless Mechani-Cut! Mail The Coupon Now!

PEERLESS
MACHINE COMPANY
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RUSH FOLDERS ON: Dept. AM-645

☐ Peerless Mechani-Cut ☐ Peerless Hydra-Cut ☐ Peerless Utility Saw

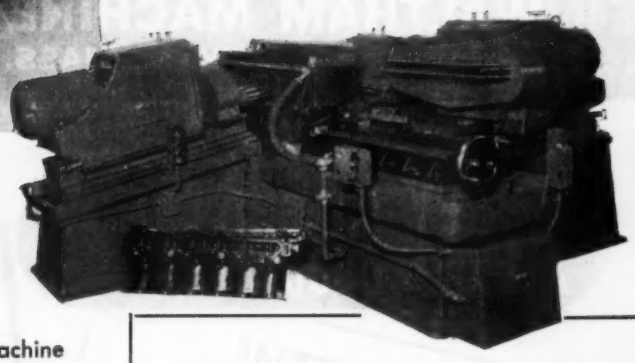
Company _____ Individual _____

Street _____ City _____ State _____

Time...

IS YOUR MAIN COMPETITOR

Says "Stop-Watch Pete" of Baush



Old style equipment would make it impractical to even estimate on a job such as illustrated. The speed of today's production makes modern machine tools a MUST.

The Baush 3-Way Hydraulic Multi-Spindle Drilling machine handles this complicated operation with speed, accuracy and economy. All-out war production—taxing the production capacity of thousands of plants—could never have reached such heights without equipment like this.

Are your machine operating times fast enough to meet such competition?

Let a Baush Engineer—backed by over 50 years of leadership in this field—help you meet tomorrow's competition. Send us your boring, tapping, drilling or reaming problems—there is no obligation.

Descriptive literature sent upon request.

Illustrated above is a Baush 3-Way Hydraulic Multi-Spindle Unit performing 76 drilling operations on Rolls Royce Cylinder Head and Insert Assembly at Continental Aviation & Engineering Corp. plants in Muskegon and Detroit, Mich.

38 Stud Bushing Holes on Intake Side are drilled and countersunk.

8 Stud Holes on Intake Side are Step Drilled.

24 Stud Holes on Exhaust Side are Step Drilled.

1 Oil Line Hole on Exhaust Side is Drilled.

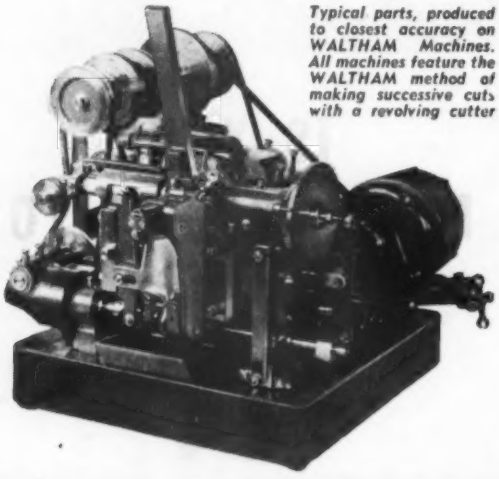
5 Core Holes on Exhaust Side are drilled and counter bored.

BAUSH MACHINE TOOL CO.

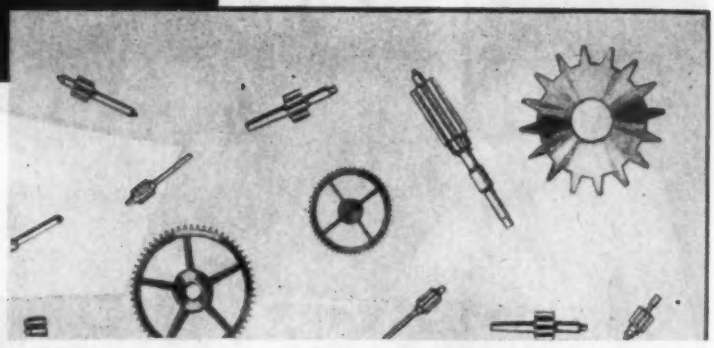
SPRINGFIELD 7 **MASSACHUSETTS**

WALTHAM
PINION & GEAR CUTTING MACHINES

for precision production of fine pitch mechanisms



Typical parts, produced to closest accuracy on WALTHAM Machines. All machines feature the WALTHAM method of making successive cuts with a revolving cutter



Single-Cut Pinion Machines This machine employs one cutter. Blank is positioned and machine started by hand, all other movements being automatic.

Multiple-Cut Pinion Machines Two or three cutters on arbor of cutter spindle make successive cuts. Machine stops on completion of last cut.

Magazine-Fed Pinion Machines Provides continuous production of one kind of pinion. Magazine is loaded and all other operations including cutting and ejecting are automatic and continuous.

Gear Cutting Machines Single and Multiple cut machines equipped with special cutter swing provide the means of cutting teeth on gears up to 1½" pitch diameter and in a stack ¾" to 1" long.

Write for literature giving detailed specifications

WALTHAM MACHINE WORKS
WALTHAM, MASS.

WALTHAM
TRADE MARK REGISTERED U S PAT OFF

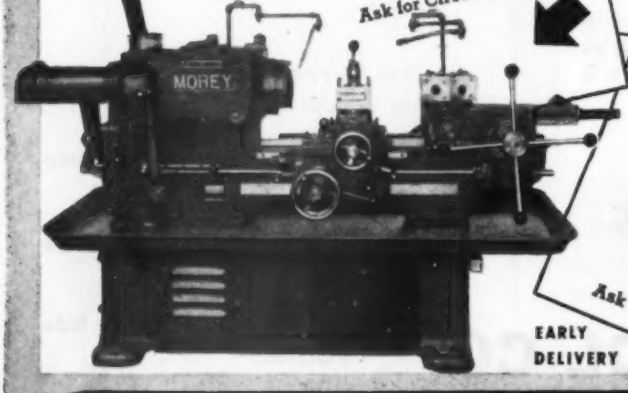
MOREY TURRET LATHES
for BAR *or* CHUCKING { UNIVERSAL or PLAIN

3 UNIVERSAL
For bar stock up to 1½" in diameter
10" turning length
16½" swing over bed
Infinite spindle speeds: 55 to 1800 RPM, constant speed motor, 1200 RPM
AVAILABLE ALSO WITH PLAIN CROSS SLIDE
Ask for Circular 727A

2 PLAIN-GEARED
For bar stock up to 1" in diameter
Turning length 6½"
Swing over cross slide 6"
Swing over bed 14"
Infinite spindle speeds:
Minimum of 60 RPM.
Maximum of 2000 RPM.
Constant horsepower at all speeds.
Ask for Circular 629A

4 UNIVERSAL
For bar stock up to 2" in diameter
12" turning length
19½" swing over bed
Infinite spindle speeds: 35 to 1500 RPM, constant speed motor, 1200 RPM
AVAILABLE ALSO WITH PLAIN CROSS SLIDE
Ask for Circular 736A

EARLY DELIVERY



- INFINITE SPINDLE SPEEDS —Electrically Selected—
- DIRECT BELT DRIVE AVAILABLE AT HIGH SPEEDS ELIMINATES GEAR MARKS (patents applied for).
- GEARED SPINDLE SPEEDS INSTANTLY AVAILABLE THROUGH MULTIPLE DISC CLUTCHES.
- SPINDLE MOUNTED ON TIMKEN BEARINGS.
- RIGID—WITH SUFFICIENT POWER TO TURN AT THE HIGHEST SPEEDS AND FEEDS MODERN TOOLS WILL WITHSTAND.
- SPINDLE SPEEDS AND POWER FEED CHANGES WITHIN EASY REACH OF OPERATOR.

ARMY E NAVY

THE DESIGN OF THE MOREY No. 2, 3 and 4 TURRET LATHES ARE BASICALLY ALIKE. EACH MACHINE IS ENGINEERED FOR THE SIZE WORK IT IS DESIGNED TO HANDLE.

DESIGNED AND BUILT BY
MOREY MACHINERY CO., INC
410 BROOME STREET, NEW YORK 13, N. Y.
PLANT: 4-57 26TH AVE., ASTORIA 2, NEW YORK

Longitudinal Feed — 20"
Cross Feed — 9"
Vertical Feed of Knee — 16"
Standard Table — 9" x 32"
Special Tables up to 48" available, also longitudinal power feed
Weight with Shaping Unit — 2000 lbs.

Obsolescence is a term that is never thought of in conjunction with BRIDGEPORT TURRET MILLING MACHINES. Not only are these machines actually ahead of the times but their advanced features will maintain their advantageous position and still be modern for many years to come. "BRIDGEPORT" combines speed and precision with low cost milling, drilling, boring and shaping . . . all in one machine, at all angles and at one setting of the work . . . and that is something that is away ahead of today's usual practice. Get full details now.

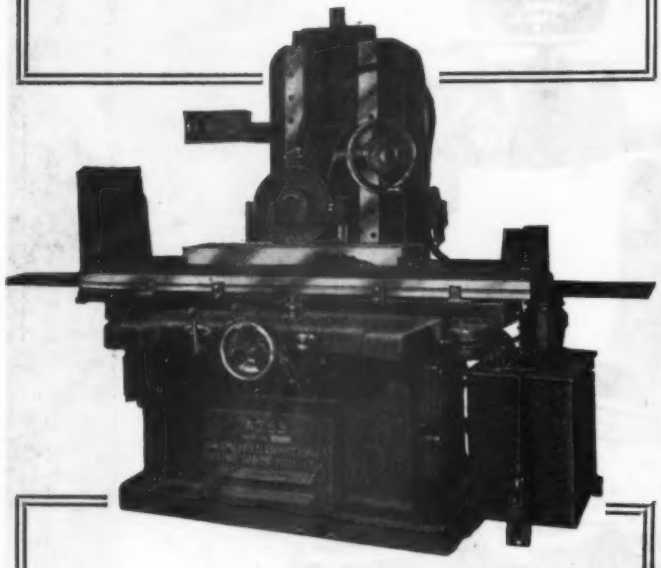
The Bridgeport MACHINES, Inc.
Bridgeport, Conn.

GRAND RAPIDS

No. 55

Hydraulic Feed

SURFACE GRINDER



CAPACITY 12"x17"x36"

. . . for Toolroom or Production close tolerance grinding . . .

The No. 55 Grand Rapids is designed to assure high speed and accuracy. It has a table working surface of 12" x 36", an automatic longitudinal table travel of 38" and a traverse travel of 13½".

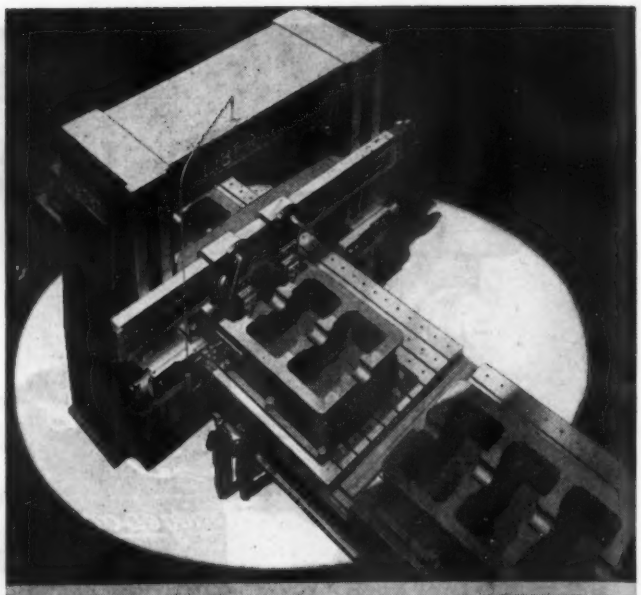
Features include the massive, sturdy "Grand Rapids" one-piece column and base, a construction which assures permanent alignment of cross travel and upright head ways. Saddle is a one-piece heavy rigid casting; spindle is mounted on preloaded ball bearings. Hydraulic feed assures smooth work.

Ask for Bulletin GL-100 describing the full line of Grand Rapids Grinders of this type.

GALLMEYER & LIVINGSTON CO.

300 Straight Ave. S.W.

GRAND RAPIDS 4 **MICH.**



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SMALL, MEDIUM AND HEAVY DUTY

PLANERS

FOR HIGH SPEED, LOW COST PRODUCTION

LIBERTY PLANERS • HAMILTON, OHIO, U. S. A.

Over a Quarter Century of Specialized Experience with Time Tested Principles of Design

1905 **Strand** **1945**

FLEXIBLE SHAFT MACHINES

VERTICAL AND HORIZONTAL TYPES
⅛ to 3 H.P.

Swivel Yoke Types
¼ to 1½ H.P.

ONE HUNDRED TWENTY-FIVE TYPES and SIZES

Small Bench Types
⅛ to ½ H.P.

HIGHEST QUALITY MACHINES

HIGH SPEED STEEL ROTARY FILES . . . ROTARY CUTTERS

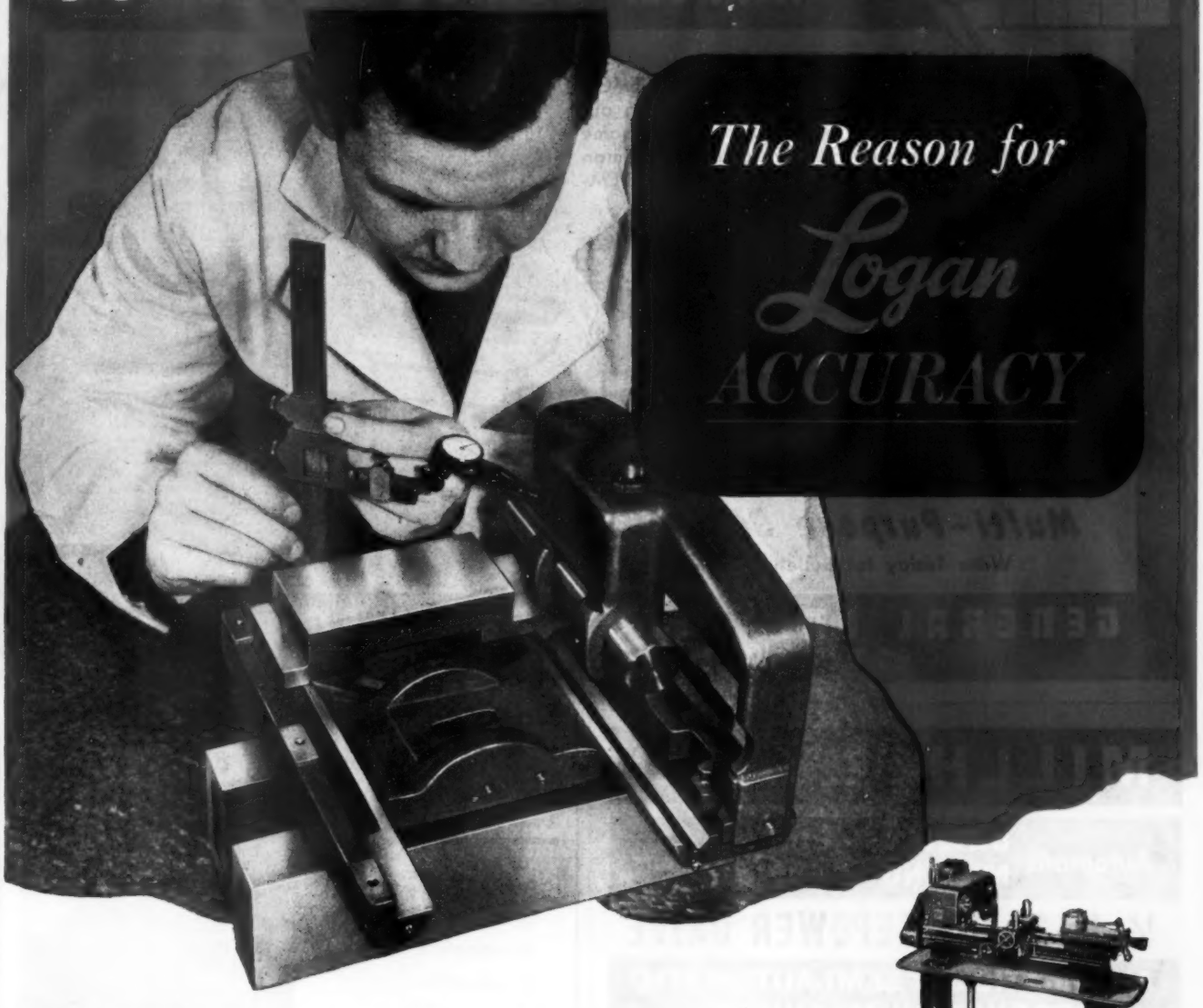
Send for our new 112 page Catalog No. 29

Largest Flexible Shaft Line in the World

N. A. STRAND CO.

CHICAGO 40, ILL. **5001 NO. WOLCOTT AVE.**

Logan A NAME TO REMEMBER WHEN YOU THINK OF BETTER LATHES



ACCURATE work comes from Logan Lathes because accurate work goes into building them. Typical of maximum tolerances allowed are the following: Bed ways are within .0005" of absolute parallelism. The bearing faces in Logan headstocks are held to an accuracy of .0005". The front bearing seat on the Logan Lathe spindle can vary no more than .0002". The only way to hold tolerances as close as these in lathe after lathe is to maintain a highly organized, rigid inspection system.

That is why one of every seven men building Logan Lathes is an inspector, skilled in the use of precision instruments such as Comparators, Johannson Blocks, Sine Bars, and the most accurate of gauges. Using this precision equipment, Logan inspectors check every operation involved in building the lathe, individual parts, sub-assemblies, and completed machines. They make certain, in short, that every Logan Lathe will work accurately because every part of that lathe fits accurately. True, this Logan stress on inspection represents a large investment, both in fine equipment and skilled personnel. But it is also the wisest economy. The lathes which pass such rigid inspection make friends of the men who use them. Ask your Logan Lathe dealer, or write, for full information on all models of Logan Lathes.

No. 850
Manufacturing Turret Lathe

No. 825
Quick Change Gear Cabinet Lathe

SPECIFICATIONS common to all Logan Lathes: Swing over bed, 10½"; Bed width across ways, 6-15/16"; Bed length, 43⅛"; Size of hole through spindle, 25/32"; Spindle nose diameter and thread: per inch, 1½"—8; 12 Spindle speeds . . 30 to 1450 r.p.m.; Size of motor . . ⅓ or ½ h.p., 1750 r.p.m.; Preloaded precision ball bearing spindle mounting; Drum type reversing motor switch and cord; Precision ground ways, 2 prismatic "V" ways, and 2 flat ways.

LOGAN ENGINEERING CO.
CHICAGO 30, ILLINOIS

D-1

"Production Time Cut 25% with our GEMCO Shapers!"

'MUCH satisfied with performance of our GEMCO Sharpers. They cut the time of machining our motor yokes 25% of the time it took to do the same job on our old shapers"—says the General Foreman of a leading Motor and Generator Mfr., using GEMCO 24" Production Type Shapers.

You, too, can produce better products—more speedily, accurately, economically! Replace your worn-out, obsolete machines with new precision GEMCO Shapers . . . Exclusive "LUBRIGARD" Safety Device increases the Precision Life.

Available in
Plain Type: Sizes 16" and 20"
Production Type: Sizes 16" to 24"
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Multi-Purpose SHAPERS

Write Today for Bulletin GC-12A

Manufacturers of PRECISION MACHINERY Since 1917

GENERAL ENGINEERING & MFG. CO.
ST. LOUIS 4, MISSOURI

MILLHOLLAND

Automatic DRILLING - BORING MILLING - TAPPING Units

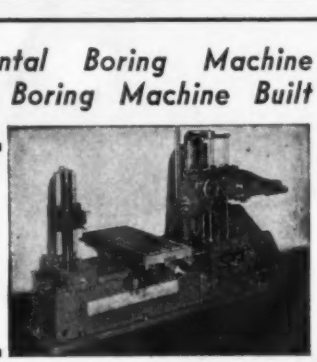
½ to 20 HORSEPOWER DRIVE

AUTOMATIC and SEMI-AUTOMATIC PRODUCTION MACHINERY

W. K. MILLHOLLAND MACHINERY CO.
Indianapolis, Ind.

UNIVERSAL *Horizontal Boring Machine*
The only TRIWAY *Boring Machine Built*

Made in 3" and 4" spindle sizes. Write for complete, detailed specifications.

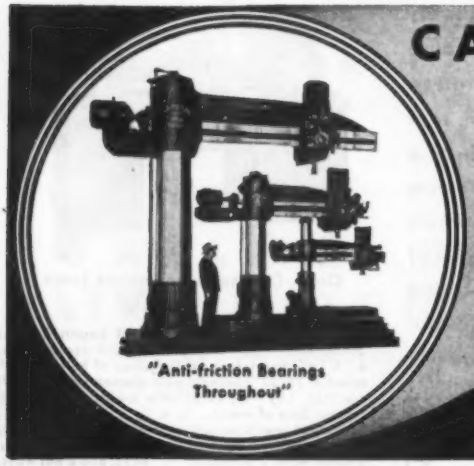


Standard Universal 3" Spindle Machine

UNIVERSAL BORING MACHINE CO.
Hudson, Mass., U. S. A.

CARLTON RADIAL DRILL

FEATURES—1. Low Hung Drive to the Spindle. 2. All Power Driven Parts Running in Oil. 3. Quiet Running at all speeds. 4. Concentrated and Convenient controls. 5. Constructed on Unit Principal.



"Anti-friction Bearings Throughout"

The **CARLTON**
MACHINE TOOL COMPANY
CINCINNATI, OHIO, U. S. A.

ARMY E NAVY

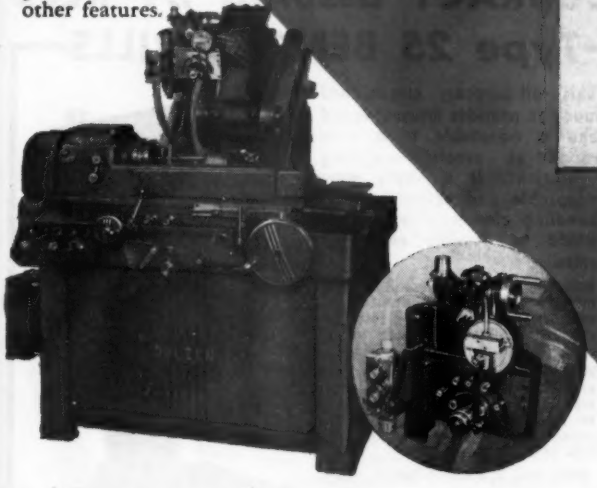
Do it with DALZEN

Left: Dalzen taps, in U. S., Metric, Whitworth, and Special forms are precision ground of hardened high speed steel in a complete size range. TUNGSTEN CARBIDE TAPS — EITHER SOLID OR INSERT—A SPECIALTY.

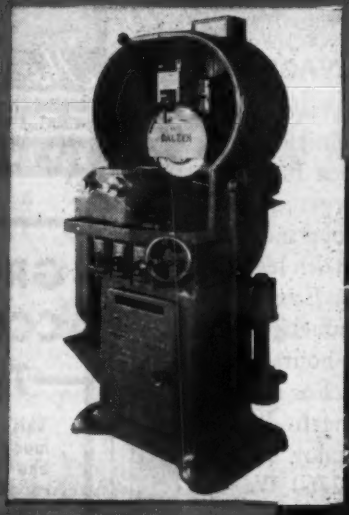
Left: High speed ground thread milling cutters, scientifically heat treated for longer cutting life

Dalzen manufactures an extensive line of precision cutting tools, parts, thread grinding and special machines — engineered for maximum efficiency and economical operation. Each is the result of years of experience on the part of designers and craftsmen. These are reasons why, all over the United States and in many foreign countries, master mechanics who have used and worked with Dalzen-made machines and tools say, "You can do it better with Dalzen." Write for details on how Dalzen can "do it better" for you.

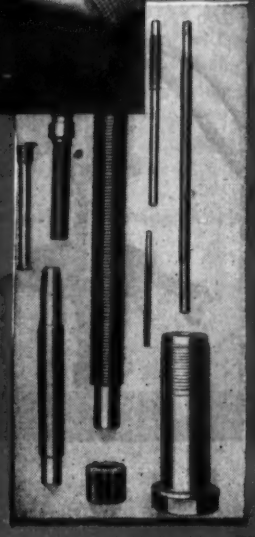
Below: No. 5 *Electronic* Thread Grinder. Easy to operate. High production efficiency and accuracy by controlled wheel speed, motor driven dresser, automatic compensation and other features.



Right: No. 2 Thread Grinder. Compact, upright design saves floor space. Simple to operate. Low first and maintenance cost. Ideal for short or production runs.



Below: Dalzen "2-in-1" combines a dependable, accurate center lapping machine with a sturdy drill press. Saves on equipment costs, floor space.



Right: Threaded parts are ground to close tolerances exactly to your specifications. Rigid inspection standards assure a uniform fine finish. Jobs requiring rolled or cut threads are also handled.

DALZEN

TOOL AND MANUFACTURING CO.

12255 EAST EIGHT MILE ROAD • DETROIT 5, MICH.

SAVE *Critical* TIME!

TIME CANNOT BE SALVAGED

Once it's gone there's no reclaiming it. But you can cut your finishing time 'way down with Haskins Flexible Shaft Equipment. Forget old hand-finishing methods. Your men will work faster and better, with less fatigue, the Haskins way. Every hour will see increased production. Man-hours—plus machine-hours—will really mean something. For important new time-saver methods, send for your copy of Catalog 45. R. G. Haskins Company, 2760 W. Flournoy Street, Chicago, Illinois.

H-6

1/2 H.P. Countershaft drive, 4-speed —900—3400 R. P. M. Bench height pedestal mounting, 360 degree swivel.

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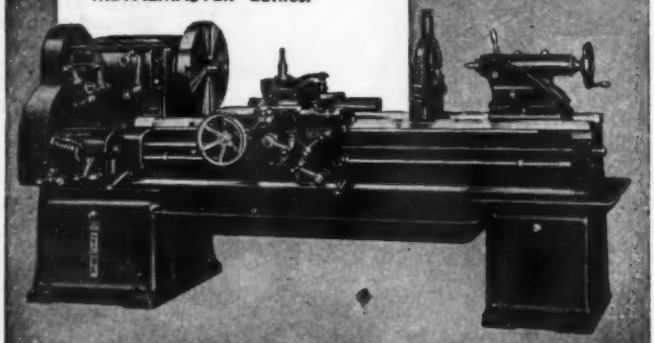
12", 14" & 16" LATHES

- Fast, accurate for war production ... durably constructed, precision built to meet peacetime manufacturing needs. Write for catalogs describing in detail the advantages of METALMASTER Lathes.



The BRADFORD MACHINE TOOL Co

MANUFACTURERS OF METAL WORKING LATHES; CAM FEED DRILLING AND TAPPING EQUIPMENT, HYDRAULIC DRILLING MACHINES . . . IN BUSINESS SINCE 1840

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GREATER EASE *and* FINER ACCURACY *assured by* REED

***Type 25* BENCH DRILLS**

This all-purpose, streamlined machine provides unusual speed and is adaptable to a wide range of precision drilling operations. It is vastly more adaptable and economical for handling classes of work than would be possible on larger units.

Safe construction—specially recommended where women operators are employed—is provided by total enclosure of all moving parts except chuck.

A Reeves Variable Speed Drive provides an instantly hand-wheel controlled speed variation from 1500 to 10,000 R.P.M. Speeds are indicated on graduated disc in plain view of operator.

Made in 1, 2, 3 and 4-spindle types.

Specifications

Capacity—¼"
Spindle Travel—3"
Head Adjustment—3"
Bench Space — (Single Spindle) 15" x 32¼"
Spindle to Column—7"
Belt and Chuck—standard equipment

Write for literature giving full details

PRODUCTION MACHINE CO.

Manufacturers of Drilling Machines, Tool Grinders and Hand and Automatic Polishing and Grinding Machines.

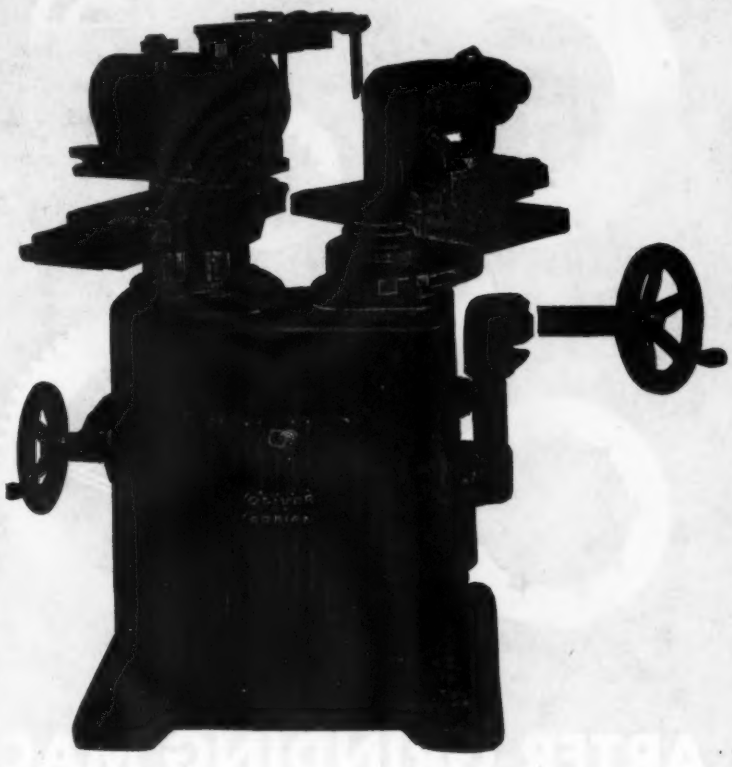
GREENFIELD, MASS., U. S. A.

For Today's and Tomorrow's

HIGH SPEED MILLING—

KEEP TOOLS CONDITIONED

WITH THE . . .



OLIVER No. 2 ARC FACE MILL GRINDER

Don't Neglect Your Toolroom It's the Backbone of Production!

Old methods of grinding milling cutters won't do today . . . or in tomorrow's civilian production either! The high speed cutters used on modern heavy-duty milling machines require very careful precision grinding to give the true round corner which is vital to maximum production. And the Oliver ARC Face Mill Grinder is doing that scientific grinding job—easily and quickly—in plants all over the nation today! It grinds the correct face and periphery on all types of face mills (and other types of cutters), and creates a round corner between these two surfaces, blending the corner exactly into the cutting edges—and giving the form that results in maximum production and greatly reduced cutter breakage. Sharpens any radius from 0" to 2"; any angle from 0° to 90°; any angle of dish, plus or minus. Grinds cutters from 6" to 26" dia. Extra sturdy. Precision built throughout. Write for details.

OLIVER INSTRUMENT COMPANY, 1414 E. Maumee St., Adrian, Michigan.

Oliver OF ADRIAN

AUTOMATIC DRILL GRINDERS—TOOL AND CUTTER GRINDERS—DRILL POINT THINNERS—TEMPLATE TOOL GRINDERS—FACE MILL GRINDERS—DIEMAKING MACHINES

Typical ARTER Versatility

Flat circular work requiring perfect parallelism . . . extreme flatness . . . exact thickness . . . with a particular degree of finish required. All easily obtained on

ARTER
Rotary Surface Grinders

ARTER GRINDING MACHINE COMPANY
WORCESTER, MASSACHUSETTS • U. S. A.

YOU CAN DO A WIDE RANGE OF MAINTENANCE WORK!

MURRAY POWER DRIVEN FORGE HAMMER

IF you are sharpening tools the hard way, investigate the Murray Power Driven Forge Hammer—operated either electrically or mechanically. And, that's just one of the many jobs you can do with it. It is adaptable for a wide range of light or heavy work . . . extremely powerful and built for long, dependable use, with low maintenance costs . . . adjustable for different thicknesses of materials and dies. Write for complete details today and also ask about our repair parts service.

All models furnished for either belt or motor drive.

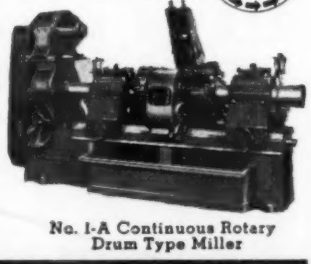
Made in 5 Sizes

D. J. MURRAY MANUFACTURING CO.
WAUSAU MURCO WISCONSIN

Horizontal ROTO-MATICS

DAVIS and THOMPSON Roto-Matic

When high production is in demand on your machining problems your requirements can be met with a Horizontal Roto-Matic. Continuous, non-indexing operation together with roughing and finishing spindles insure maximum output. ***Bulletins 110 and 120*** are available for suggested solutions to your problems.



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Davis and Thompson Co.
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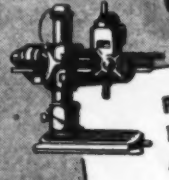
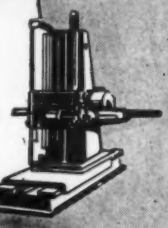
GILBERT



PRODUCTION SPEEDING RADIAL DRILLS AND HORIZONTAL DRILLING, BORING AND MILLING MACHINES



DETAILS ON REQUEST

THE CINCINNATI GILBERT MACHINE TOOL CO.
CINCINNATI, OHIO

Automatic WORK STATIONS through ONE cycle of the DIAL

There's no need today to employ several machines and a group of operators when a single Bodine multi-spindle dial-feed unit will perform up to eight different operations on one piece during a single cycle of the automatic indexing dial.

Thousands of small parts are accurately machined **per hour** . . . many thousands **per day** . . . by quickly trained operators . . . men or women.

DRILLING, MILLING, TAPPING, SCREW INSERTING *Simultaneously*

For instance: One of the almost limitless set-ups on a Bodine machine produces 7 pieces per minute with 7 different operations on each piece. This means a saving of 75% in manpower, conservation of about 50% in floor area, over previous methods.

There are six sizes of Bodines which carry from 6 to 8 spindles . . . floor area from 54" x 60" to 90" x 96".

OPERATION: The operator places the work in fixtures on the horizontal dial as it automatically indexes. 6 to 8 spindles located for milling, drilling, tapping (and, in some cases, screw inserting) can operate from vertical, horizontal, diagonal or inverted positions . . . tapping and drilling to ½" dia. and 2½" in depth. Ejection is either automatic or manual, depending upon the nature of the part. Automatic feed is also possible. Electrical interlocks protect the machine, the tools, the work and the operator.

Added features are: Low fatigue factor for operators . . . clean, simple work for older men and women employees. Bodine machines now used in war work may be retooled without delay or undue expense for civilian production.

SEND FOR THE BODINE BULLETIN SHOWING TYPICAL TOOLING SET-UPS.

Hammond
OF KALAMAZOO

ABRASIVE BELT GRINDERS-POLISHERS

Model F-2 Flexible Belt

Hammond offers in its wide line of abrasive belt machines—for either wet or dry operations—the highest standard of machine tool construction for economical, high production grinding and finishing. Write for bulletins.

Model "400" Wet-n-Dri 4" Belts

FLEXIBLE BELT UNITS

Inexpensive bench or pedestal type for replacing slow, costly hand finishing methods.

Model VH-6 Wet-n-Dri 6" Belts

GRINDERS—POLISHERS

Whatever your problem—investigate the available Hammond machine for handling it. Both bench and floor type Wet-n-Dri machines for use with abrasive belts from 2" up to 10" widths.

Model No. 8 Dri Only Up to 3" Belts

BACKSTANDS

Bench and floor types to convert polishing equipment into belt finishing units.

CYLINDRICAL FINISHING

For ¼" to 9" outside diameter tubes, rods, bars.

Backstand and POLISHING LATHE UNITS

For faster, better, large volume finishing.

Variable Speed Lathe & Backstand

HAMMOND PRODUCTS — CARBIDE, GENERAL PURPOSE AND ABRASIVE BELT GRINDERS AUTOMATIC AND CYLINDRICAL FINISHERS • POLISHING LATHES

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OF FRAMINGHAM

50th Anniversary 1895-1945

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Two colorful folders illustrate the story. Send for them if you are interested in newer and better ways to protect wartime metal products from corrosion — from all kinds of wet-dirt-moisture damage while in transit or in storage.

How INDUWRAP, because of its exclusive engineered features, is still winning the battle against corrosion for builders of airplane engines and many highly-finished precision parts. How BROWNSKIN GRIZZLYBEAR (A-19) is still helping to solve for Chrysler of Canada the problem of delivering their engines safely overseas.

These two wraps, and many others of Angier make, have proved in war their quality-right to lasting preference in peace — when peace arrives. They come from the house that has devoted a half-century of protection to the products of our nation and its industries — in peace and war.

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CORROSION PREVENTIVE AND WATERPROOF PAPERS

FRAMINGHAM, MASSACHUSETTS

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easy with DoALL Zephyr

Here it is—Friction Sawing, the modern way to cut hard, ferrous metals—to step up production as much as 7-fold.

The saw cuts with an action similar to that of "torch cutting" but there are no twisted, distorted shapes of thin materials—no jagged edges; in fact, on many jobs the finish is so smooth that further machining is unnecessary.

The Zephyr is safe. Equipped with automatic safety brake for instant work stoppage and the blade is fully enclosed in strong steel housing, except at work table.

Blade heat is dissipated by the specially-constructed, large-diameter wheels.

Best Way to Cut
STAINLESS STEEL
ALLOYS · TUBING
ARMOR PLATE
CAST STEEL · CAST IRON · ILLIUM

The DoALL Zephyr provides infinite variable speeds of 2,000 to 10,000 f.p.m. or 3,000 to 15,000 f.p.m. for cutting aluminum, magnesium, lead, zinc, brass, kirksite, copper, wood, masonite, rubber, plexiglass, plastics and laminates.

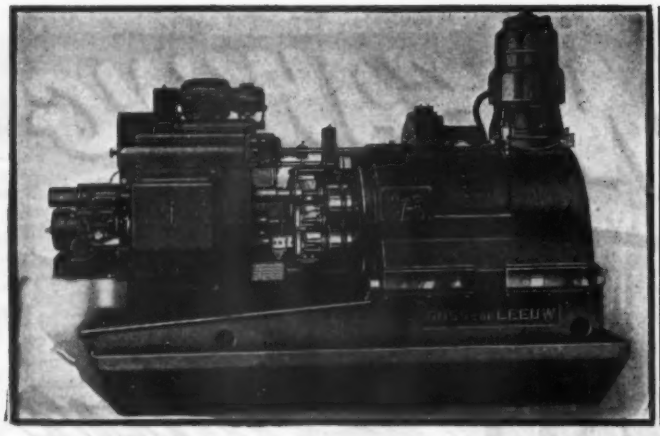
Send for copy of the new booklet FRICTION SAWING and other Zephyr performances.

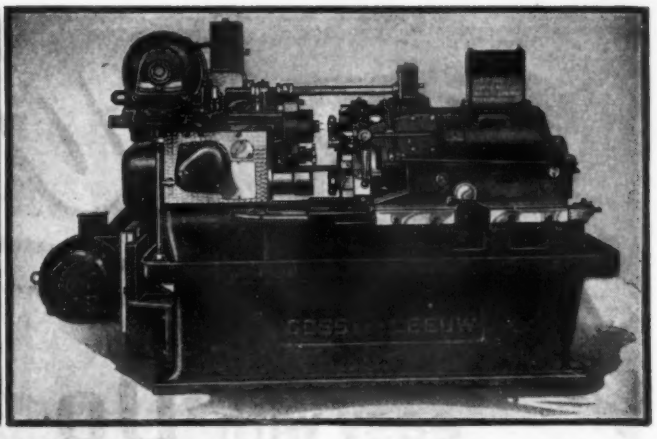
DoALL

INDUSTRY'S NEW SET OF TOOLS

CONTINENTAL MACHINES, INC.
1310 S. Washington Ave. • Minneapolis 4, Minn.

Sales & Service Offices: Baltimore, Birmingham, Boston, Buffalo, Chicago, Cincinnati, Cleveland, Dallas, Dayton, Denver, Detroit, El Paso, Erie, Grand Rapids, Hartford, Houston, Indianapolis, Kansas City, Los Angeles, Milwaukee, Minneapolis, New York, Orlando, Philadelphia, Pittsburgh, Providence, Reading, Rochester, Rockford, St. Louis, San Francisco, Seattle, Statesville, Syracuse, Toledo, Tulsa





WORK ROTATING TYPE

5 Spindles
6 Spindles
8 Spindles

GOSS & DE LEEUW *Multiple Spindle* CHUCKING MACHINES

TOOL ROTATING TYPE

4 Spindles
5 Chucking Positions

On these machines, two threading operations can be handled simultaneously, each thread controlled by its own lead screw.

Among the many other modern features offered in both types are: pre-loaded anti-friction spindle bearings, hardened ways, oversize spindles and gears of chrome-nickel steel, heat-treated.

Complete details will be found in descriptive catalog available on request.

GOSS & DE LEEUW MACHINE CO., NEW BRITAIN, CONN.

INVEST IN TIME-SAVING on SMALL TOOLROOM JOBS

The moderate cost of a LINLEY Milling and Jig Boring machine permits a generous profit return in time-saving . . . and money. Little jobs that cause confusion in many shops can be dispatched with speed and accuracy and a quick change-over from one type of work to another.

Eight speed changes to 4250 r.p.m. are easily made . . . set-up is fast. Table top of 7" x 17½" is ample for small die work, metal patterns, models, jigs, etc. Direct micrometer setting, grease-sealed bearings, counter-balance to prevent backlash in quill travel all contribute to smooth, easy operation.

An investment in a LINLEY saves your larger machines for rated capacity . . . keeps things moving as you want them.

DESCRIPTIVE BULLETIN ON REQUEST

LINLEY BROTHERS COMPANY
664 STATE ST. EXTENSION
BRIDGEPORT 1, CONN.

LUCAS "PRECISION"

Horizontal Boring, Drilling and Milling Machine
THE LUCAS MACHINE TOOL CO.

NOW AND ALWAYS OF

CLEVELAND
OHIO, U. S. A.

DAVIS KEYSEATER

This low cost machine will handle internal keyseating jobs up to 1¼ in.

Write for illustrated bulletin.

DAVIS KEYSEATER CO., 403 Exchange St., Rochester, N. Y.

ABRASIVE

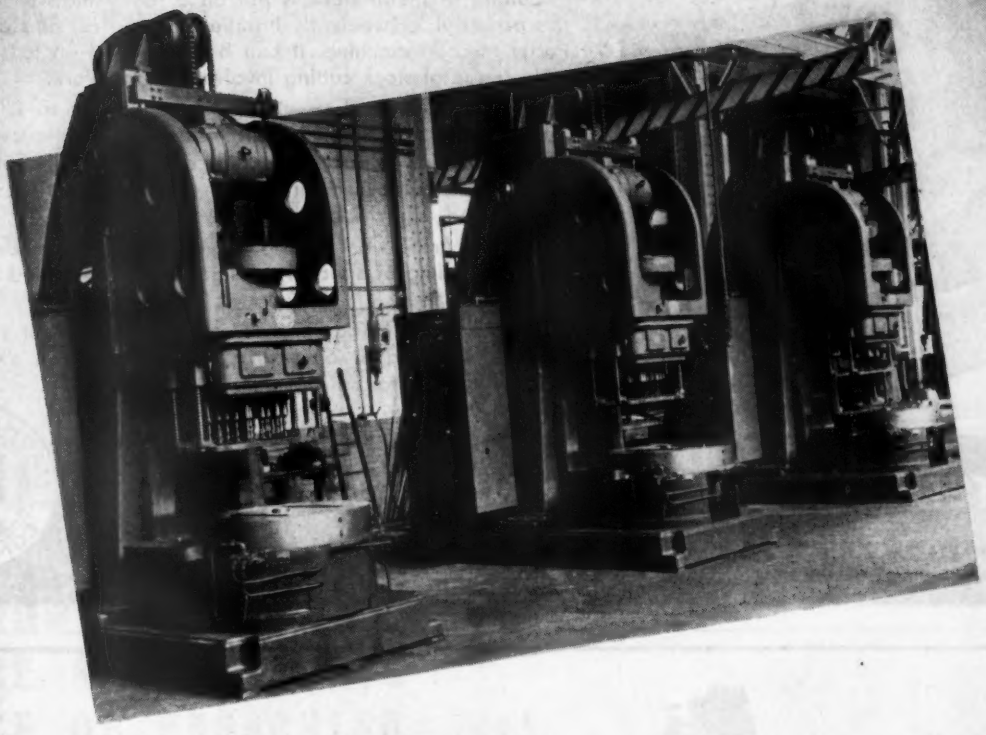
ACCURACY BOOSTS PRODUCTION

No. 1G	INTERNAL GRINDER	**No. 34**	VERTICAL SPINDLE SURFACE GRINDER
No. 1½	HAND FEED SURFACE GRINDER	**No. 3B**	AUTOMATIC FEED SURFACE GRINDER

Look for Our Full Page Advertisements

ABRASIVE MACHINE TOOL CO.
EAST PROVIDENCE 14, RHODE ISLAND

VERTICAL HYDRAULIC DRILLING MACHINE



● The Defiance No. 540 Vertical Hydraulic Feed Machine is designed for heavy duty single or multiple spindle drilling, boring, reaming, or milling operations. The above machines have 28-spindle heads and fixtures for drilling $\frac{11}{16}$" holes in large diameter plates $\frac{3}{4}$" and $\frac{3}{8}$" thick. The column is a heavy-type cored casting with long ways which carry the head slide. Weight of machine, 39,150 pounds.

Defiance Machines lead in accuracy, efficiency and cost-reducing dependability. Write for new catalog.

Defiance Machine Works, Inc., Defiance, Ohio.

ARMY NAVY

DEFIANCE

BUILDERS OF PRECISION MACHINERY SINCE 1850

Save Time . . . Cut Costs

Remarkably fast cutting of Metals is assured by

PORTER-McLEOD
COLD METAL SAWING MACHINE

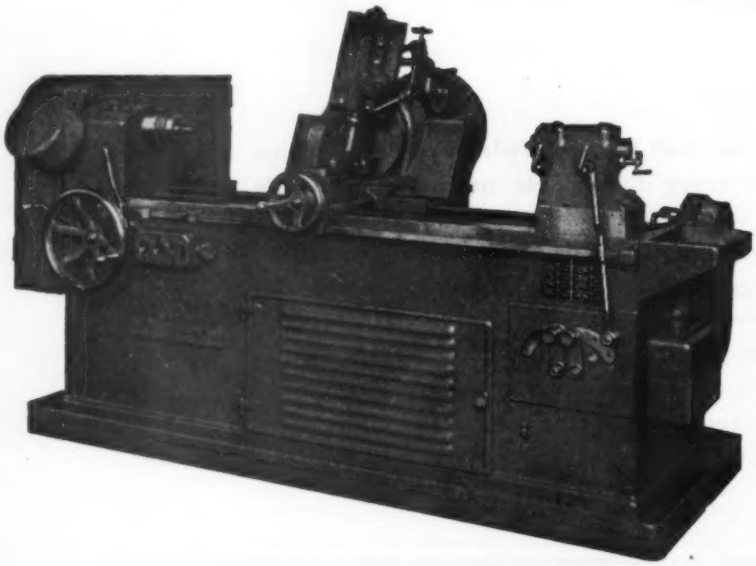
Cutting of metal stock is put on a really high production basis by this powerful, conveniently handled, clean, fast and accurately cutting Porter-McLeod machine. It can be depended on to save time on the wide range of stock cutting involved in war work.

In addition to its capacity for handling up to 8" round or 7½" square stock, this machine is provided with a unique method of holding work which enables it to nest economical quantities of bars and shapes for multiple cutting. All cutting is fast because a 3" per minute feed is provided.

Fast, accurate work and long blade wear are made possible by an upward feeding of specially designed and supported blade and by a friction disc feed.

Outline your cutting-off problem and ask for our recommendations to solve it. Send at once for Descriptive Bulletin on the 8" Porter-McLeod cold metal sawing machine.

PORTER-McLEOD MACHINE TOOL CO., INC.
HATFIELD, MASS., U. S. A.



The ADAMS Gear Hobber and Thread Miller

The Adams Manufacturing Hobber is available when there is a sufficient volume of splined shaft and spur gear hobbing to warrant the purchase of equipment for these operations only.

Here is a machine that combines precision with versatility. It hobs multiple splined shafts, spur gears and helical gears, and it will mill worm and screw threads.

THE ADAMS COMPANY
1905 BRIDGE STREET
DUBUQUE, IOWA, U.S.A.

1883 — Our 62nd Year — 1945

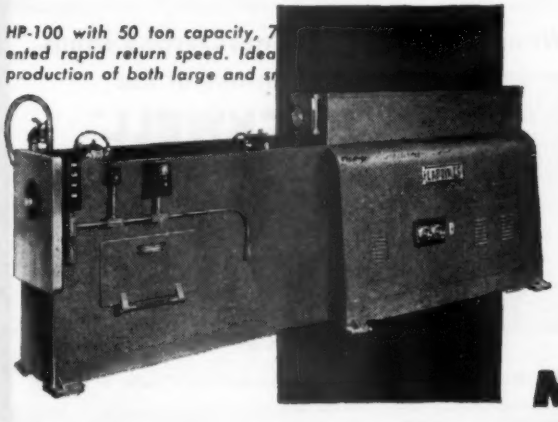
IF YOU PLAN FOR TOMORROW • • CONSULT LAPOINTE TODAY

TOMORROW'S TRIM CRAFT WILL BE BETTER BOATS BECAUSE OF BROACHING

Manufacturers with a keen eye to future market dominance have completed postwar plans . . . in which broaching will play a leading role — increasing speed, quantity and quality of production.

Boats are but one of thousands of products that will benefit through the operation of Lapointe designed broaches and broaching machines. Almost any precision part can be produced quicker, cheaper and better — by broaching. Little wonder, then, so many manufacturers have consulted the Lapointe engineering staff.

If you desire to double-check the possibility of broaching in your plant . . if you are seeking a profitable saving in time, space and money in the mass-production of precision parts . . . tell your story to Lapointe — leader in broaching for nearly half a century. Following a painstaking analysis of both your product and plant, you'll receive a recommendation certain to brighten your manufacturing future.



HP-100 with 50 ton capacity, 7
ented rapid return speed. Idea
production of both large and s

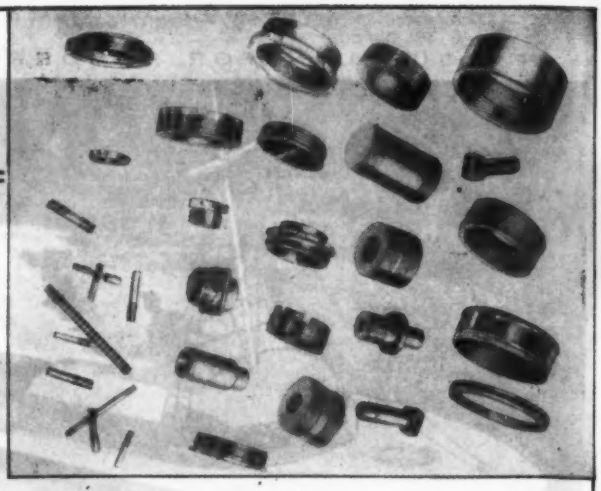
THE Lapointe

MACHINE TOOL COMPANY

HUDSON, MASSACHUSETTS • U S.A

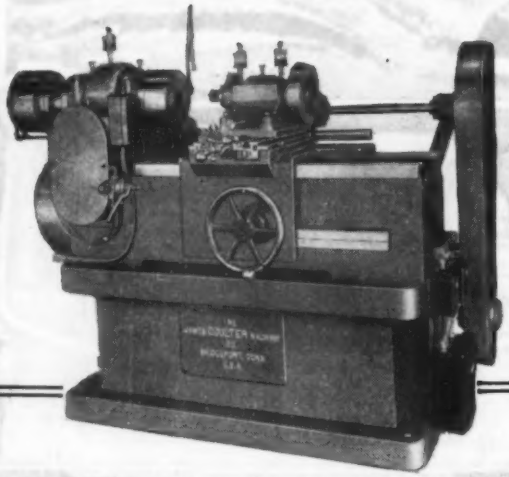
THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHES AND BROACHING MACHINES

. . . for Precision Internal or External Threads . . . Right or Left Hand



HANDLE PRODUCTION AUTOMATICALLY on the

COULTER HOB THREAD MILLER



This modern machine can be depended on to produce and duplicate close tolerance threaded parts. With the exception of loading, all operations are fully automatic. Any parts that can be held in a Universal chuck, air-operated chuck or special fixture can be threaded, on the COULTER, internally or externally, either right or left hand.

Work can be inserted from either face or rear end, through large hole in work spindle, thereby making possible the threading of shaft ends, tubing or other long work.

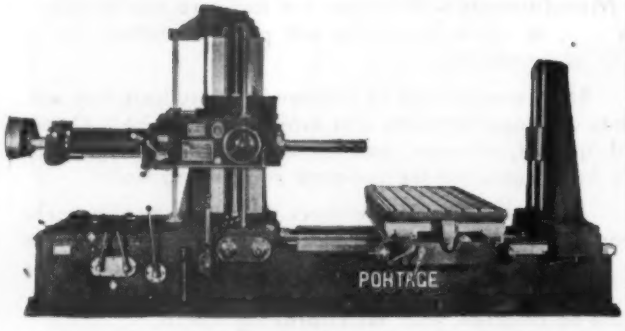
Individual Motors on the COULTER for work and cutter spindles provide a wide range of speeds and feeds for handling such materials as brass, aluminum or steel.

Illustrated literature covering full details of this machine is available promptly on request.

THE JAMES COULTER MACHINE CO.

BRIDGEPORT, CONNECTICUT

PORTAGE



NO. 4 HORIZONTAL BORING DRILLING & MILLING MACHINE

• A ruggedly built machine capable of operation at maximum speeds and feeds to produce accurately finished work. . . . Machine furnished with coolant type table with either 36" x 60" working surface and 48" cross travel, or 48" x 72" working surface and 60" cross travel. . . . Extra height columns increase working capacity. . . . For greater speed—precision—high production specify PORTAGE.

WRITE for full descriptive bulletin today.

THE PORTAGE MACHINE CO.

AKRON 11, OHIO

For cutting internal keyways, slots or splines 1/16" to 4" wide and up to 60" long. Fast—Accurate—Flexible. Write for particulars and catalog on machine for your work.

Giant KEYSEATERS

MITTS & MERRILL
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Saginaw, Michigan

SMITH & MILLS

CRANK SHAPERS

sizes 12" to 32" stroke

THE SMITH & MILLS CO. Cincinnati, Ohio

Whoever thinks of hardness testing equipment thinks of the

"ROCKWELL" HARDNESS TESTER

Now and always made only by

WILSON

MECHANICAL INSTRUMENT CO. INC.
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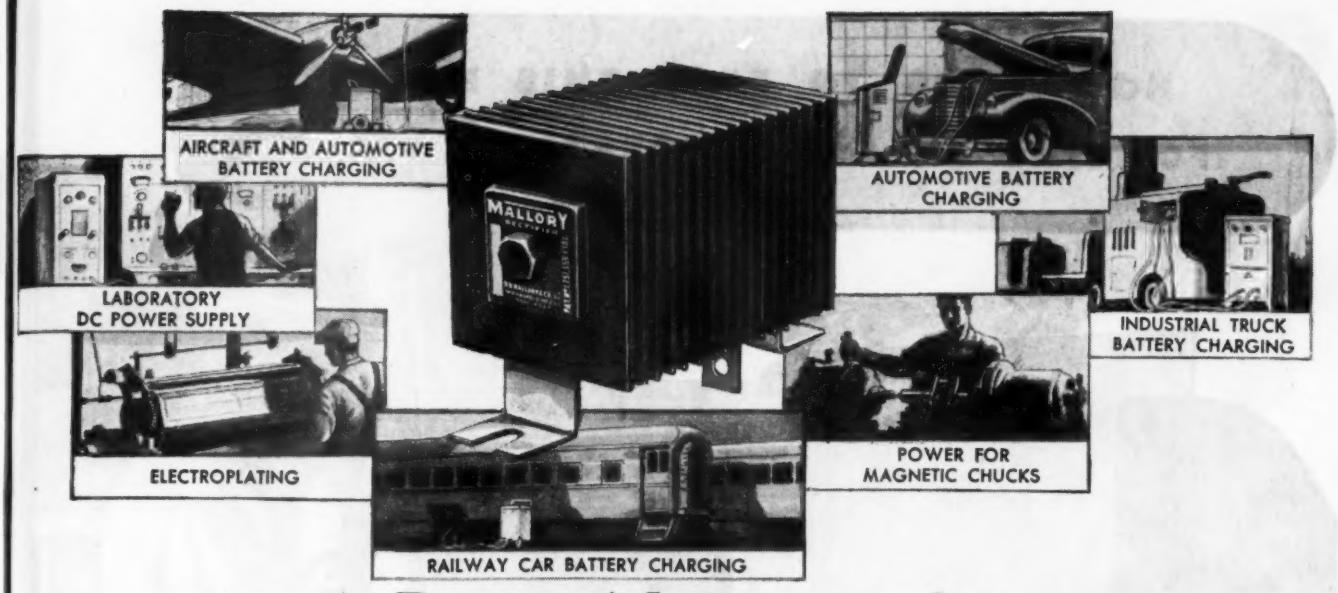
An Associate Company of American Chain & Cable



A Dozen Advantages for Dozens of Applications...

MALLORY MAGNESIUM-COPPER SULPHIDE RECTIFIERS

WHEREVER you need a dependable source of low voltage DC, Mallory Dry Disc Rectifiers provide these 12 advantages:

1. *Long Life*—Properly applied, many Mallory Rectifiers have been in continuous operation for more than five years!

2. *More compact* than any other dry disc rectifier because the high current rating of the rectifier junction permits much smaller size.

3. *Rugged, all-metal construction* — practically immune to mechanical damage and able to withstand severe shocks or sustained vibration.

4. *Completely sealed* to resist atmospheric extremes.

5. *Constant output* over a range of ambient temperatures from —40°F. to 265°F. or higher. No "aging"—constant output throughout the rectifier's long life.

6. *Will withstand heavy current overloads* — tested up to 527°F.

7. *Self-healing rectifying film* if subjected to abnormal high voltage surges.

8. *Excellent voltage regulation* over a wide range.

9. *Unity power factor.*

10. Practically no *power consumption* at "no load".

11. *Silent operation—no maintenance cost,* since there are no moving parts to wear out.

12. *Wide range of sizes and ratings*—Mallory Rectifiers are available in sizes ranging from a tiny "button" to large heavy-duty stacks, in capacities from 0.3 ampere to 175 amperes DC and higher.

Mallory manufactures the following complete rectifier units: Rectostarters* for aircraft . . . Battery chargers for automotive, aviation, railroad and industrial truck service . . . Rectopower† supplies for low voltage, medium and high current applications.

Write for descriptive catalogs, showing specifications and many applications of Mallory Magnesium-Copper Sulphide Rectifiers. Our engineers will be glad to help if you have a special problem. Or see your nearest Mallory Distributor.

†Rectopower is the registered trademark of P. R. Mallory & Co., Inc., for rectifier power supply units.

P. R. MALLORY & CO., Inc.,
INDIANAPOLIS 6, INDIANA

*Rectostarter is the registered trademark of P. R. Mallory & Co., Inc., for rectifier units for use in starting internal combustion engines.

P R MALLORY & CO Inc
MALLORY
RECTIFIERS

MAGNESIUM COPPER SULPHIDE RECTIFIERS—
STATIONARY AND PORTABLE D. C. POWER SUPPLIES—
BATTERY CHARGERS AND AVIATION RECTOSTARTERS*

Railroad shop men call it a guide bar. But by any name this rough forging, measuring 4-15/32" x 3-15/16" x 61½" long, would take plenty of minutes for facing 4 sides with cutting tools.

With a Diamond Face Grinder the job is a cinch. You simply set it up against a magnetic chuck and in approximately 100 minutes floor-to-floor you're finished—sizing to 4"x3½" on the nose.

Face grinding produces the first flat surface regardless of surface conditions, saves time and material. Face grinding with the heavier, huskier Diamond Face Grinder is easy to learn.

"THE DIAMOND D THAT CUTS YOUR COSTS"

MAIL TODAY FOR NEW FOLDER

Diamond Machine Company of Philadelphia
2405-D Aramingo Avenue, Philadelphia 25, Pa.

Gentlemen: Please send me promptly your Bulletin 44-G which shows how to speed-up production with the Diamond Face Grinder.

Name_____ Title_____

Company_____

Address_____ State_____

City_____

GEARGRIND

FORMED WHEEL *Grinding*

FOR ALL TYPES OF PRODUCTION

The first formed wheel grinding of splined shafts occurred in the fall of 1909, when The GEAR GRINDING MACHINE COMPANY delivered a thousand shafts and transmissions to Hudson Motor Company.

During the following 36 years the Formed Wheel Method of grinding has been refined, perfected and applied to many types of production. By grinding after hardening, distortion due to heat treatment is eliminated.

Standard GEARGRIND Machines offer you accuracy—production—superb finish—over a wide range. Special machines can be designed to perform special grinding operations.

The GEARGRIND catalog covers all types of machines, as well as our contract grinding service for experimental or production jobs.

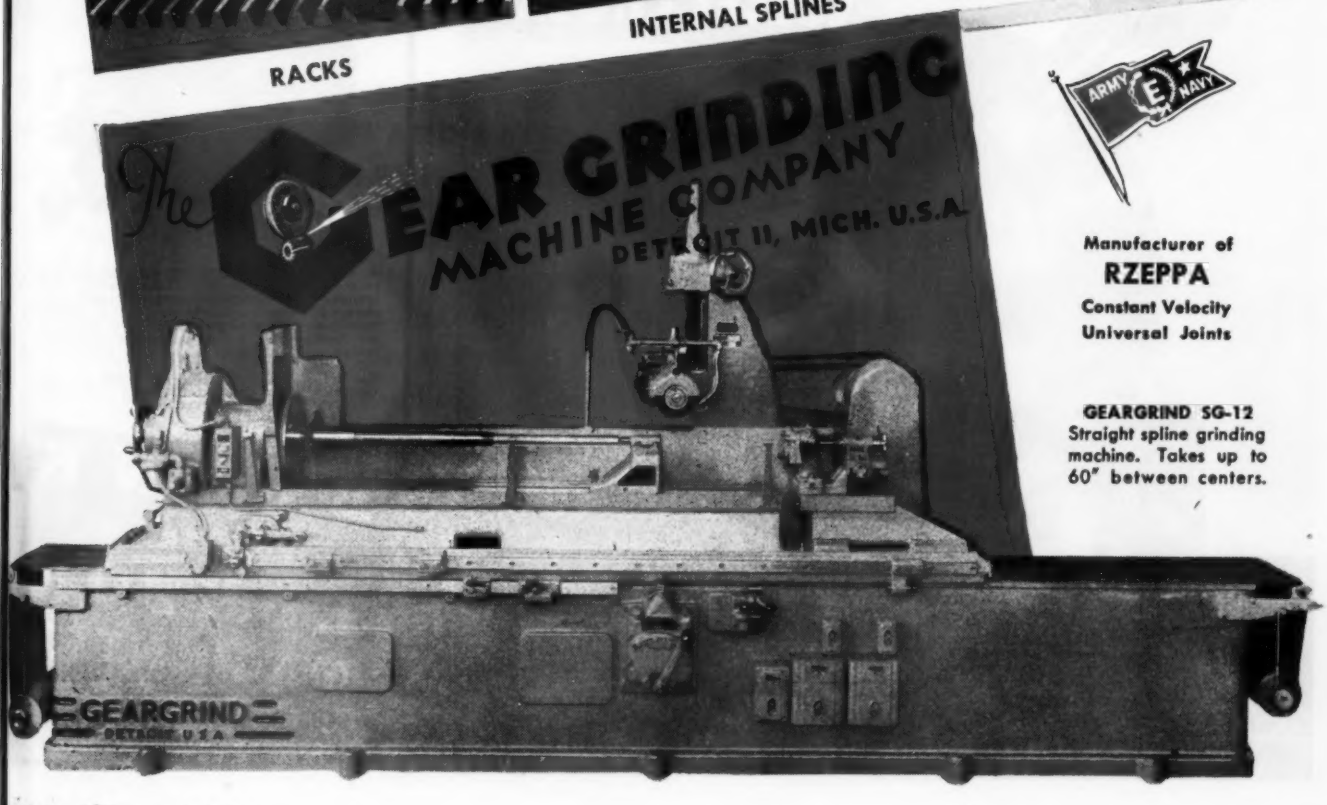
EXTERNAL GEARS

INTERNAL GEARS

EXTERNAL SPLINES

RACKS

INTERNAL SPLINES



ARMY E NAVY

Manufacturer of

RZEPPA

Constant Velocity Universal Joints

GEARGRIND SG-12
Straight spline grinding machine. Takes up to 60" between centers.

METAL CUTTING COSTS Reduced with KALAMAZOO Band Saw

CONTINUOUS HIGH SPEED CUTTING
on any metal and all shapes

Step-up PRODUCTION in cutting off bars, rods, angles, tubes, etc., to lengths with this accurate, low cost, metal cutting coolant equipped band saw.

Why use large, high priced equipment on jobs more easily handled by this NEW, modern method?

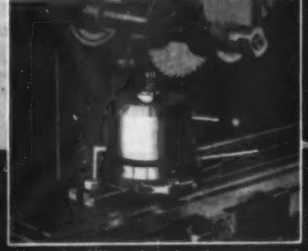
Quick setup—automatic operation—plugs in anywhere. Saves time and labor. Cuts investment and maintenance.

Two sizes—8" x 16" and 8" x 24". Four speeds. Available without coolant attachment for intermittent cutting. ***Write for Bulletin or Ask your Dealer***

MACHINE TOOL DIVISION KALAMAZOO TANK & SILO CO. KALAMAZOO, MICHIGAN

In Canada—Bridge Machinery Company, Montreal

Allison COLLET CHUCKS



Above is Allison Indexing base mounted with an Allison #1 chuck doing second operation work.

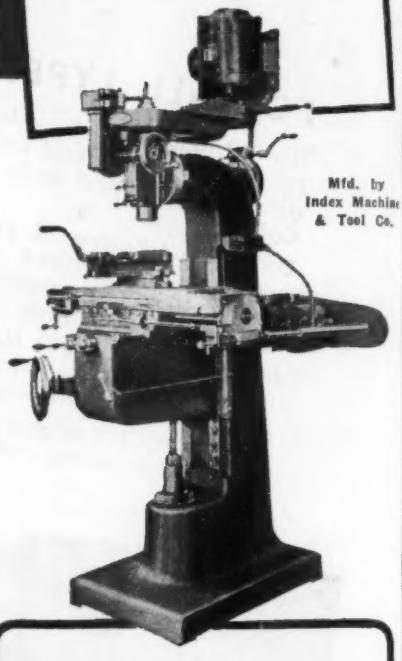
Model #1 for 1½" 8-thread spindle lathes — with ⅞" collet capacity is unsurpassed as a combination chuck for either first or second operation work.

WRITE FOR NEW ALLISON CATALOGUE
SEE YOUR LOCAL DISTRIBUTOR

Allison TOOL & ENGINEERING COMPANY
4031 Whittier Blvd., Los Angeles 23, Calif.

INDEX MILLS

will help you on your tool, die and production work. In addition to micrometer dials on screws, verniers are standard equipment for cross and longitudinal locating. If finer precision is desired, rods and indicators are available. These in conjunction with power feed to a precision ball bearing spindle make a very versatile machine for milling, drilling and boring. *Literature promptly mailed on request.*



Mfd. by Index Machine & Tool Co.

12" Tool Room Rotary Table

Mfd. by Index Machine & Tool Co.

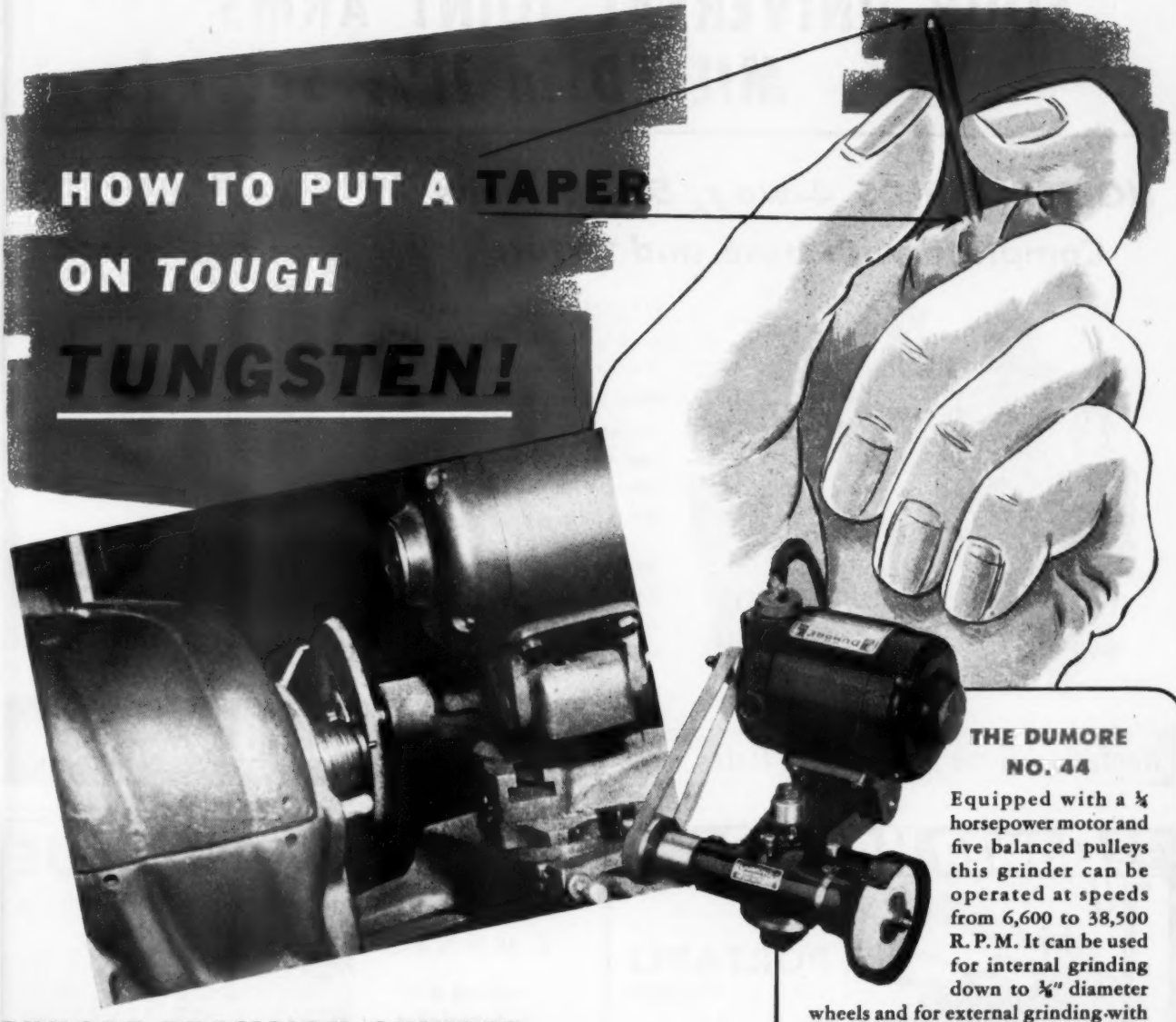
A quality tool for precision work in the tool room or production line, incorporating such features as ball bearings—hardened and ground worm—quick acting throw-out for free hand turning—single movement table lock that does not cramp table out of alignment—compound trough. 12" size only.

For use on Index Mills or any other machine that will accommodate a 12" table.

BLANK and BUXTON MACHINERY

3100 E. MICHIGAN AVE.
JACKSON, MICH.

HOW TO PUT A TAPER ON *TOUGH* TUNGSTEN!



DUMORE PRECISION GRINDER MOUNTED ON STANDARD LATHE LICKS DIFFICULT SHAPING JOB!

Putting a taper on this small tungsten rod proved too tough a job for cutting tools so a wise shopman solved his problem with a Dumore No. 44 Precision Grinder. Mounted on a standard lathe and using a special 6" wheel running at 5,000 R. P. M. the Dumore handled the job easily, accurately and at a satisfactory cost. Thousands of other shops are reporting similar results with their Dumores. The flexibility and adaptability of this unique precision grinder gives skillful toolmen the means for licking many a tough job. Discover its possibilities yourself—write for Catalog today! The Dumore Company, Tool Division, Dept. TF14, Racine, Wisconsin.

THE DUMORE NO. 44

Equipped with a ⅓ horsepower motor and five balanced pulleys this grinder can be operated at speeds from 6,600 to 38,500 R. P. M. It can be used for internal grinding down to ⅛" diameter wheels and for external grinding with a 3" diameter wheel. Versatile and compact, the No. 44 can be used on a lathe with as little as 8" swing. It is a precision built tool for work to .0001" tolerances with the stamina to stand up under constant production operation.

6 OTHER MODELS... 3 HAND GRINDERS!

Get this Catalog which describes the complete Dumore line. Write for your copy today!

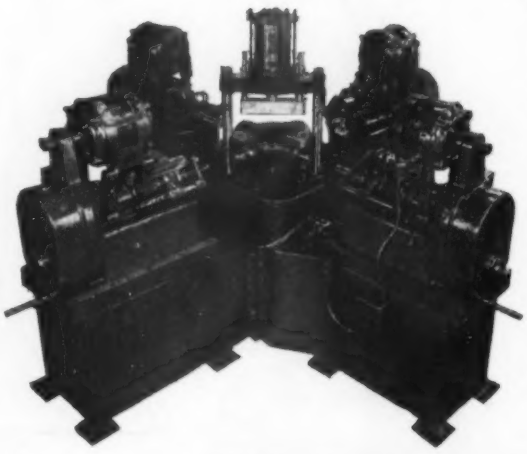
DUMORE

PRECISION AND HAND GRINDERS

Sold by Authorized Industrial Distributors in All Principal Cities

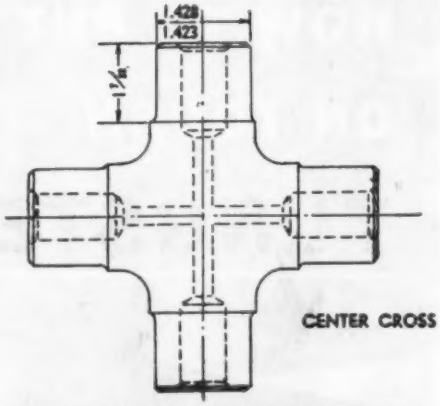
FOUR UNIVERSAL JOINT ARMS
MILLED in 11½ Seconds

HOEFER BUILDS 4-way, 5 h. p. Units
Complete with base and fixture



SAE 4620 Forging used for center crosses for all sizes of motor propelled war machines required hollow milling operation of 1-7/16" diameter. Speed 50' per minute. Feed .050" per revolution. Travel 1¼".

Special purpose machine for this job featured central hydraulic controls to move heads simultaneously.



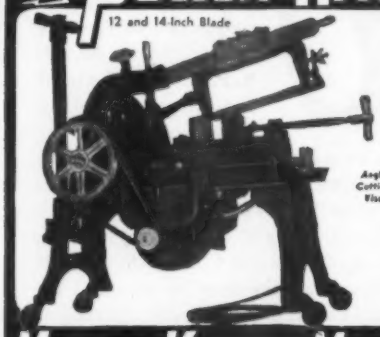
One of several Hoefer Self-Contained Hydraulic Units, mounted on a suitable inexpensive base or on another machine, make up a special high production machine at a fraction of the cost for specially designed equipment.

Possibly our experience can be of value to you in considering your present production problems and in planning for the future.

Hoefer's Whole Business is Holes . . . . **HOEFER MFG. CO.** *Freeport, Ill.*

POWER HACK SAW ★

12 and 14-Inch Blade



LOW PRICED
•
PORTABLE
SELF-CONTAINED
•
Angle Cutting Also
READY TO WORK
STURDY
ECONOMICAL
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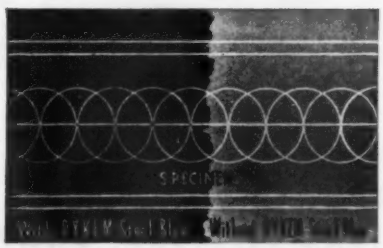
MILLER-KNUTH MFG. CO. OMAHA, NEB.

DYKEM STEEL BLUE

STOPS LOSSES

making dies & templates

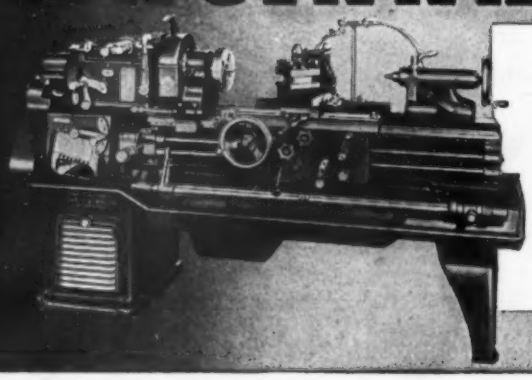


simply brush on right at the bench; ready for the layout in a few minutes. The dark blue background makes the scribed layout lines show up in sharp relief, and at the same time prevents metal glare. Increases efficiency and accuracy.

Write for full information

THE DYKEM COMPANY, 2301 B N 11th St., St. Louis, Mo.
In Canada: 444 Pacific Ave., Toronto, Ont.

CINNATI LATHES



LOOK INTO THE TOOLING POSSIBILITIES OF THESE MODERN COST-CUTTERS

It will pay you to submit your drawings or samples of jobs to be machined so that our engineers may offer suggestions for tooling up to handle production on the "Cincinnati", the "Lathe with Low-Cost Records on a Wide Range of Work." On these machines it can be handled faster and more conveniently. Investigate . . . outline your problem . . . send for literature. Sizes from 14" to 30".

THE CINCINNATI LATHE & TOOL CO.
Rogers Road, Oakley SPECIALISTS SINCE 1906 Cincinnati, Ohio

Construction Features that Contribute to...

★ VERSATILITY
★ SPEED
★ ABILITY
★ ACCURACY
★ RIGIDITY
★ ACCESSIBILITY and LOW COST
★ PERFORMANCE

POSITIVE CONTROL: Multiple dry disc clutch and leather faced brake in main spindle drive gives operator positive control with flexibility to allow "inching" spindle.

16 SPINDLE FEEDS: Gears of alloy steel, heat treated, finish machined and shaved, mounted on short, ground shafts and ball bearings, provide sixteen spindle speeds, in either direction.

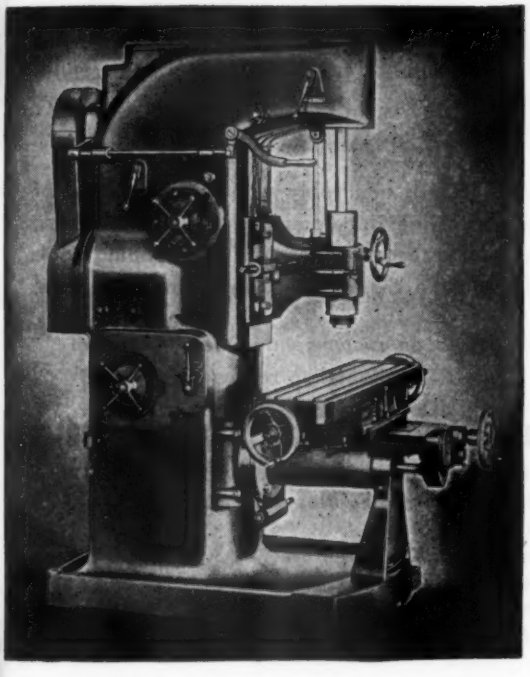
SMOOTH SPINDLE DRIVE: Hardened, ground, and lapped spiral-bevel gears, ball bearing mounted, make sure a smooth spindle drive.

BORING RANGE: Four vertical spindle feeds for boring range from .002" to .010" per revolution.

SPINDLE HEAD SECURELY LOCKED: Positive, quick acting spindle head clamp controlled by a single lever, securely locks spindle head in any position on accurately fitted slide on face of column.

MAIN SHAFT: Single, constant speed motor drives main shaft through multiple V-belts. Compact and accessible. Motor and drive entirely enclosed for safety and cleanliness. Guard easily removed for servicing or adjustment.

TABLE UNIT: A post, accurately ground and rigidly fitted into the column, forms the bearing on which the table unit swivels around the column.



KNIGHT *Millers are fast, compact, complete and convenient to handle. Write for our catalog that pictures and describes various jobs being done.*

ALL-PURPOSE KNIGHT-Millers

KNIGHT VERSATILE MILLERS ACCURATE • RIGID

TILTING TABLE: Large trunnion, on which is assembled the table unit, provides for tilting table in either direction. This feature and the one above add to the capacity of the machine.

35° TILT: The knee, actuated by large worm and gear, may be tilted 35° either side of horizontal thereby placing the table in position for angle boring or milling. Four heavy T-slot bolts solidly lock it in any position.

SAFETY FEATURE: Automatic safety throwout, built into feed mechanism, provides against over-loading and will not allow re-engaging table feeds until overload is removed.

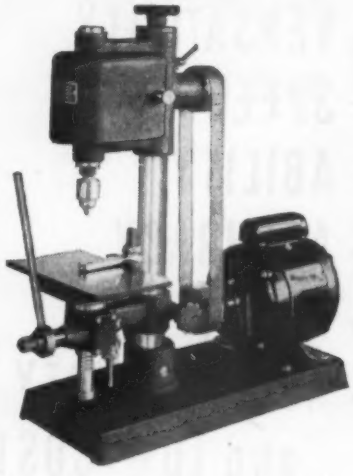
MAINTAINING SQUARENESS: Eccentric bushing, in outer table unit support bearing, furnishes additional means of maintaining squareness between table and spindle.

POSITION OF UNIT IN DEGREES: Large worm for operating gear that tilts table unit. Graduated segment on right side of unit gives position of unit in degrees.

KNIGHT Millers subject to prior order for immediate delivery. Write for catalog.

W. B. KNIGHT MACHINERY CO.
• ST. LOUIS, MISSOURI •

HAMILTON TOOLS BUILT FOR PRECISION WORK



HAMILTON SENSITIVE TAPPER

Like all other Hamilton Tools this tapper is precision-built for precision work. Ideal for instruments, cameras, watches, clocks and all other light work. Easy to operate . . . attach to any light socket.

HAMILTON "VARIMATIC"

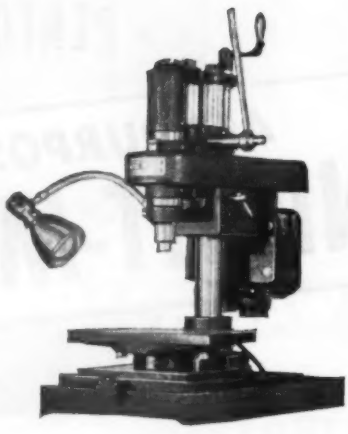
Instantaneous variable speed adjustment in two ranges.

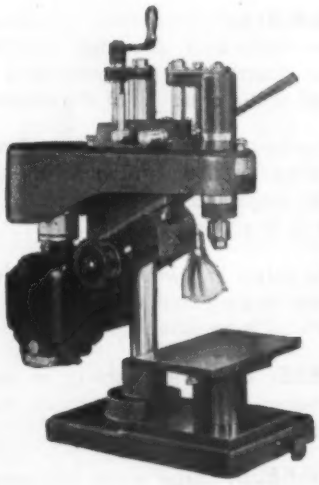
Low range 840 to 2700 r.p.m.

High range 2900 to 9300 r.p.m.

Drill capacity, .004" to 5/16".

Full floating spindle especially designed to eliminate belt pull on the spindle.





HAMILTON MAXI-JR-E

For drilling small holes from .004" to .250" diameter. Self contained drilling unit swings radially on the column and can be locked in any desired position. Can be ganged for sequence operations or to increase production. Possible spindle speeds from 750 to 8750 r.p.m.

Full floating spindle specially designed to eliminate radial belt pull on the spindle.

WRITE FOR BULLETINS ON HAMILTON TOOLS

The Hamilton Tool Co.

830 NINTH ST. HAMILTON, OHIO

Wm. Jessop Tool Steels

Wm. Jessop's HIGH CARBON HIGH CHROME ALLOY "C" TOOL *and* DIE STEEL . . .

Non-Abrasive—Non-Deforming
High Production

Made from same base materials as the world-famed Carbon Tool Steels. It can be annealed to machine more readily than High Speed Steel and will take a high finish. Resists scaling on heating and corrosion under moist conditions. This Wm. Jessop steel is air- and oil-hardening and hardens to great depth, retaining cutting hardness after several grinds. It has no peer among so-called non-abrasive steels.

Alloy "C" Steel is admirably suited for all classes of blanking, drawing and trimming dies and punches. It is specially recommended for the hobbing tools used for making dies for moulded plastic products.

Full details on recommended heat treatment available on request.

OTHER WM. JESSOP TOOL STEELS

Wm. Jessop's Extra Best Cast Steel
Superior Oil-Hardening Non-Deforming Tool Steel
J-4 Alloy Tool Steel
Special Carbon Cast Tool Steel
Ordinary Carbon Tool Steel
B. B. Hot Die Steel
Wm. Jessop High Speed Steels

"Jessop Quality Tool Steels set new production records"

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Wm. Jessop & Sons, Inc.

627 SIXTH AVE. NEW YORK, N. Y.

Branch Warehouses: Chicago, Boston and Detroit

You get plenty of power from easily-held, smooth-running *CLECO GRINDERS*

FROM "snagging" in the cleaning room to light finishing on forgings, dies, etc., you will find the *right* model for *every* job in the extensive line of Cleco Rotary Grinders. These grinders feature rugged alloy steel rotors, heat treated and ground to exact size — insuring vibration free operation at all speeds. Governors efficiently control the speed, whether idling or under varying loads, providing ample power at all times plus utmost economy in air consumption. Highest grade ball bearings are used throughout. An efficient lubrication system helps increase the life of the tools. Bulletin 80 describes Cleco Grinders in detail and includes a large blueprint of construction details. *Ask for it!*

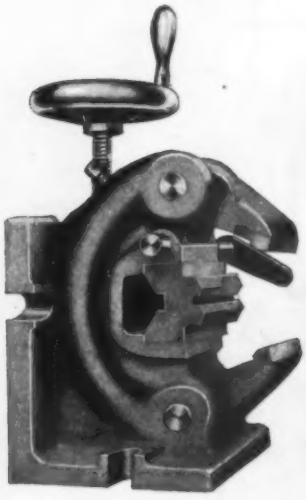
THE CLEVELAND PNEUMATIC TOOL COMPANY • 3781 East 77th St. • Cleveland 5, Ohio

Branch Offices in all Principal Cities

Heavy Duty Model B45S
Light Grinders, Models 214J and 9G
Vertical Grinder, Model 1460, with flexible pad and abrasive disc.
Help FINISH THE FIGHT!
Buy More War Bonds!
Light Grinder, Model 214

PRODUCTO

SELF-CENTERING SHAFT VISE



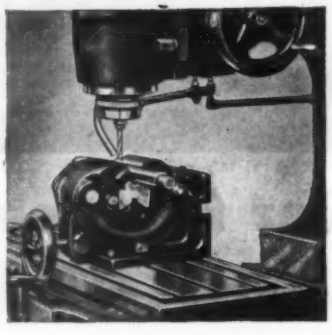
One vise that every shop needs

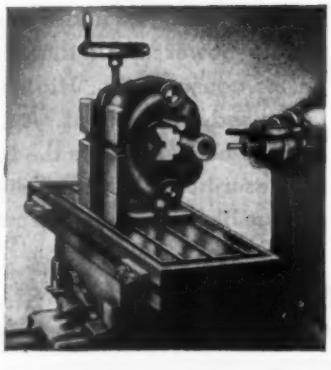
You will find a hundred uses for this powerful, time-saving vise.

It holds shafts or spindles — any diameter from 3/8" to 3 1/8" — accurately in position for machining slots, splines or keyways.

Accurate radial cuts are assured by the unchanged setting for all work-diameters. Shafts are always correctly located in V jaw by equal movement of the two clamp-jaws.

Can be mounted horizontally or vertically. V jaw is hardened and reversible. Base size, 8"x 7 1/4". Weight, approximately 80 lbs.





Write for the Producto Vise Bulletin, "Tools Every Shop Needs"

THE PRODUCTO MACHINE COMPANY

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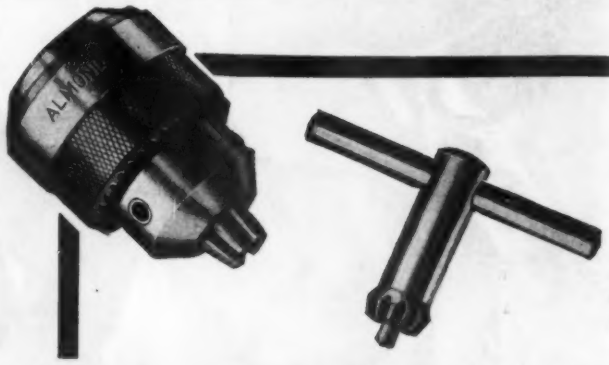


Almond Drill Chuck

THE FIRST IN THE FIELD

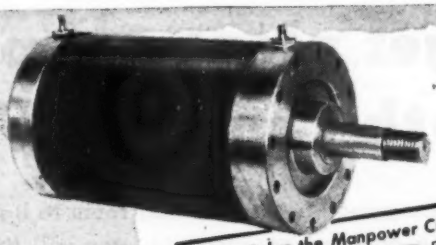
ALMOND THREE-JAW DRILL CHUCKS were the first to be placed on the market over Seventy years ago. As Pioneers in the field of Drill Chucks, the name "ALMOND" has long been associated with the logical procedure of machine developments. ALMOND DRILL CHUCKS are made in types and sizes to fit all machine tools and portable drills.

Complete information is available on request.

The Original Manufacturers of Drill Chucks

T. R. ALMOND MFG. CO.

Ashburnham, Mass., U.S.A.



Help Solve the Manpower Crisis with

AIRGRIP

Dual Action

STATIONARY CYLINDERS

"AIRGRIP" Two-Fisted CHUCKS

Double Gripping power externally or internally . . . AIR plus a 2-way cam wedge locking. Jaws stay locked if air supply fails.

When buying new lathes, specify "Airgrip" Chucks and Revolving Air Cylinders.

For controlled pull, push, lift or grip, "Airgrip" *Dual Action* Stationary Air Cylinders give the fast, smooth, dependable power that does the job right. Require no skilled labor to take apart or assemble. No tie-rods; either end of cylinder can be removed. Piston packings graphite-treated. Require no adjustment. Wear automatically taken up by air pressure.

OTHER ANKER-HOLTH COST REDUCERS include "Airgrip" Chucks, Revolving Air Cylinders, Collets, Arbors, Mandrels, Lubricating Assemblies, Air Valves, etc. Also, Hydraulic Pressure Units and Fittings.

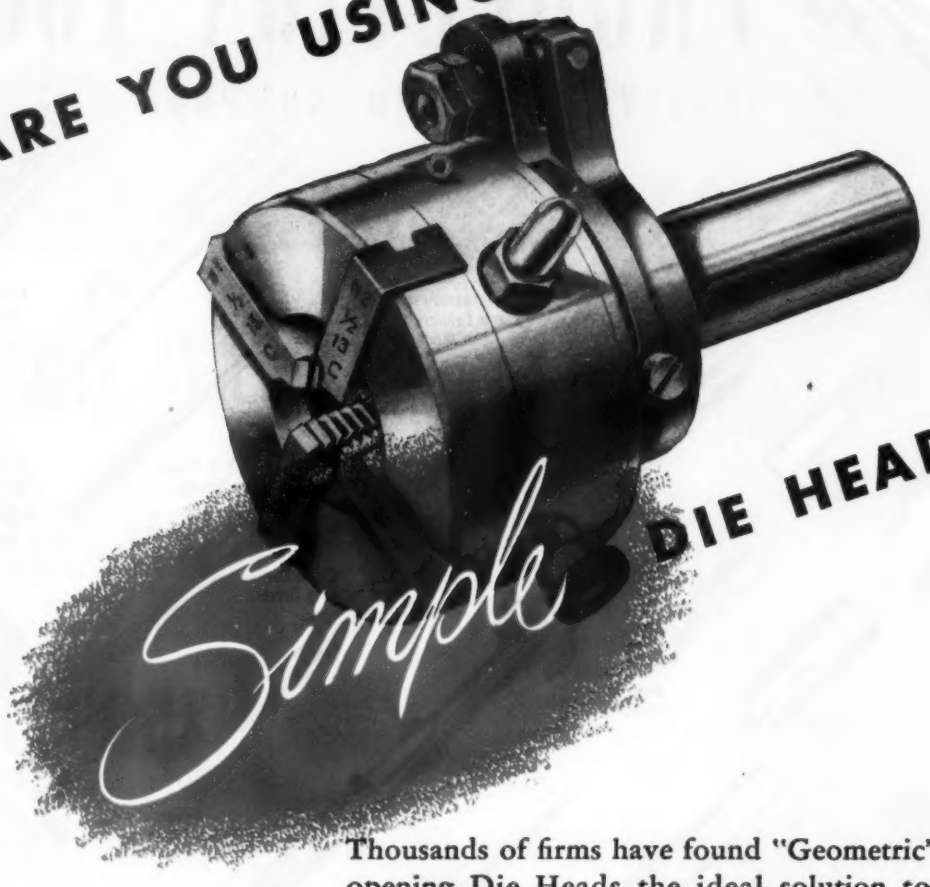
Write, mentioning products on which you desire Bulletins

ANKER-HOLTH MFG. CO.

2791 Connors Street Port Huron, Michigan

1125PE

ARE YOU USING THIS *Simple* DIE HEAD ?



The Tool illustrated is a "Geometric" Style D-S Self-opening Die Head, designed primarily for use on Brown & Sharpe Automatics but also adaptable for other machines where fine pitch, short length threading is desired.

Thousands of firms have found "Geometric" Self-opening Die Heads the ideal solution to their external threading problems because they are so simple that even a novice can operate them. Easy to set up. Easy to operate. Easy to re-sharpen chasers. And a speed and accuracy of production that means real dollar savings on your production threading.

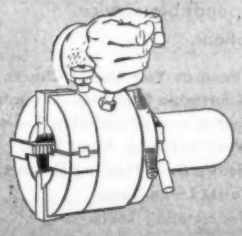
The GEOMETRIC TOOL COMPANY

New Haven 13, Connecticut

A DIVISION OF THE GREENFIELD TAP and DIE CORPORATION

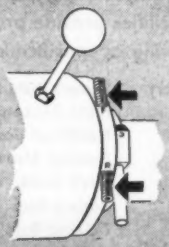
IT'S SO SIMPLE TO CUT GOOD THREADS WITH A "GEOMETRIC"

1. SIMPLE TO OPERATE



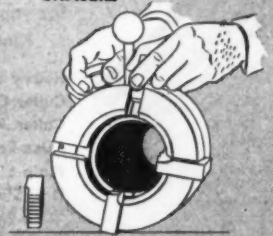
Positive camming arrangement releases chasers automatically so die head can be withdrawn from work without reversing.

2. SIMPLE TO ADJUST



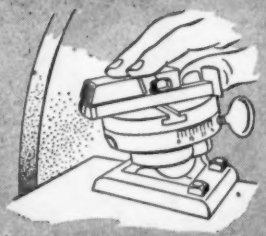
A quick and positive adjustment of the chasers to the required decimal size may be made by means of two opposed adjusting screws.

3. SIMPLE TO CHANGE CHASERS



Just pull a stop plunger and the chasers can be taken out in an instant and replaced. Spring tension keeps chasers from falling out by themselves.

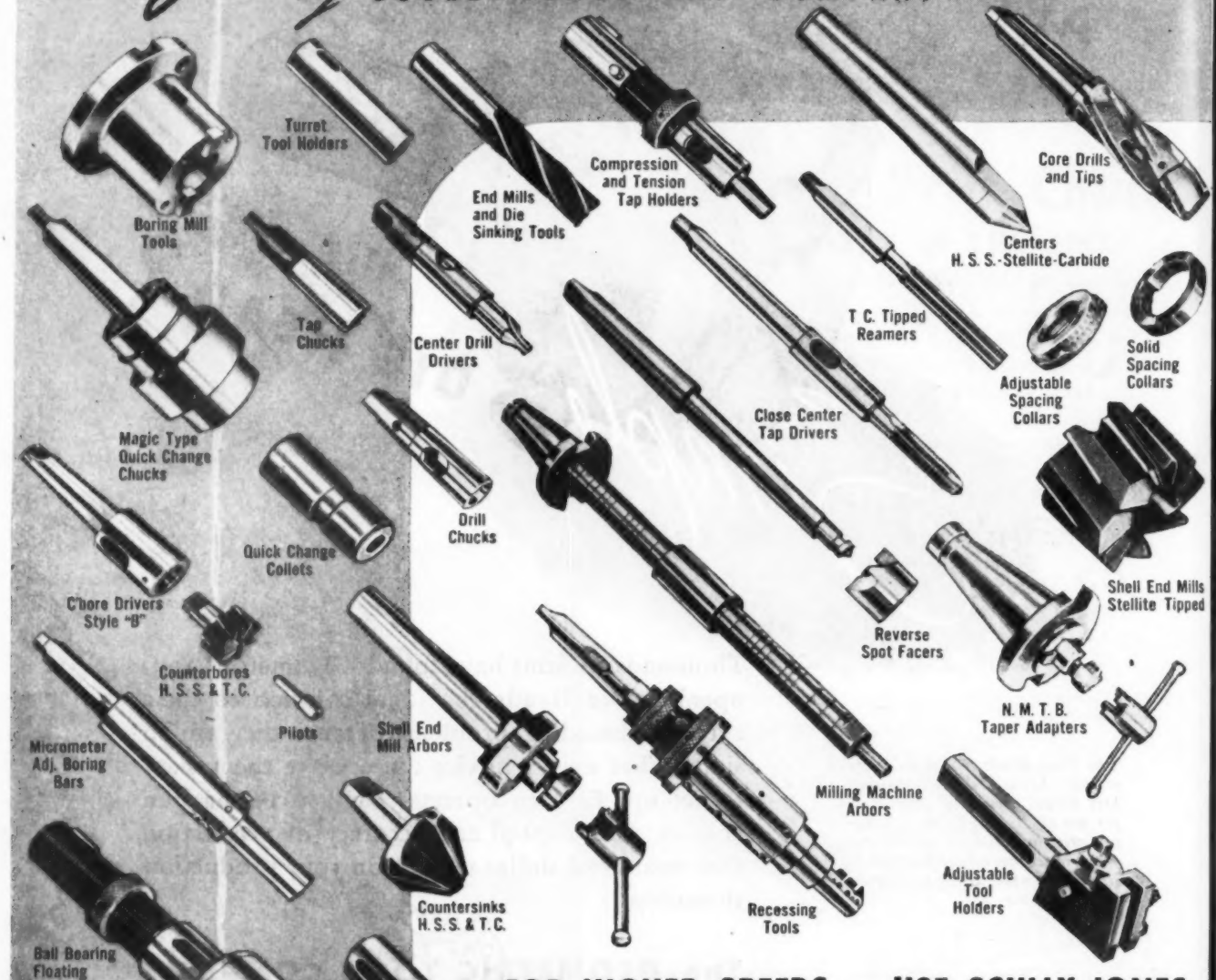
4. SIMPLE TO RE-SHARPEN



Chasers can be removed quickly from die head and can be sharpened accurately by means of a simple grinding fixture.

High PRODUCTION TOOLS

by SCULLY-JONES AND COMPANY



FOR HIGHER SPEEDS . . . USE SCULLY-JONES STANDARD AND SPECIAL PRODUCTION TOOLS

Where cutting speeds must be increased to keep pace with modern methods, Scully-Jones and Company tools will effect a substantial saving by increasing production, giving better finish, longer tool life at a lower cost per unit produced.

Years of experience and engineering knowledge assure the correct tooling for your job. Our facilities provide prompt and dependable service.

Kindly send drawing or specifications for quotations.

Heavy Duty Tap Holders	Square Hole Sockets	"Feed as You Need" Chucks
Cutter Chucks	Plain Sockets	Adjustable Extension Assemblies
Cutter Adapters	Hardened Sockets	Facing and Chamfering Tools
"Use-Em-Up" Sleeves	Bearing Sleeves	Wear Resisting Alloy Tools
Plain Sleeves	Shell Drills	Heavy Duty Floating Holders
Drill Sleeves	Boring Bars	Turret Lathe Tools
"Use-Em-Up" Sockets	Driving Bars	Undercutting Tools

Also Tools of Special Design to Meet Your Particular Machine Operations

SCULLY-JONES AND COMPANY 1901 SOUTH ROCKWELL STREET CHICAGO 8, ILLINOIS, U. S. A.

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Users find many ways to save with Standard

Using costly lubricants where ordinary lubricants are good enough is like pouring money down a rat hole.

Expensive lubricants are protected against waste.

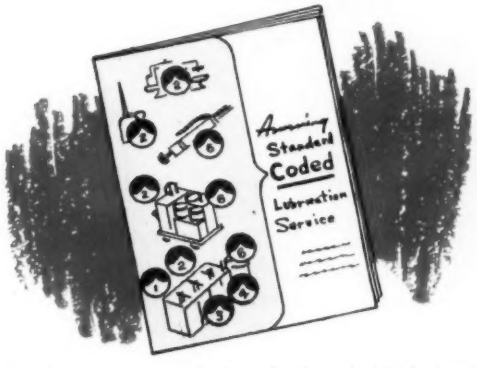
The *right use* of lubricants is of as much interest to us, the supplier, as it is to you, the user. That is why this simple method of getting the *right* lubricant in all the *right* places—Standard Coded Lubrication Service—is offered to all companies in the Middle West served by Standard Oil Company (Indiana).

1 CODED 2 LUBRICATION

A central state plant superintendent says, "Your Coded Lubrication Service solved one of my biggest headaches. We use many types of lubricants. Some are rather special and costly. With your system I am more certain that these special products are used where they should be and *not* used by mistake where ordinary lubricants are good enough."

This plant man gets a two-way saving. Expensive equipment is protected against breakdowns caused by the use of the wrong lubricant.

Send for this booklet



Find out how simple Standard Coded Lubrication Service is to install and keep up. A Standard Oil Lubrication Engineer will be glad to discuss its application with those in charge of lubrication in *your* plant. Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois, for a copy of the booklet or the Lubrication Engineer nearest you.

Buy more War Bonds

STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

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How to cut lubricant leakage and throw-off . . . safely!!

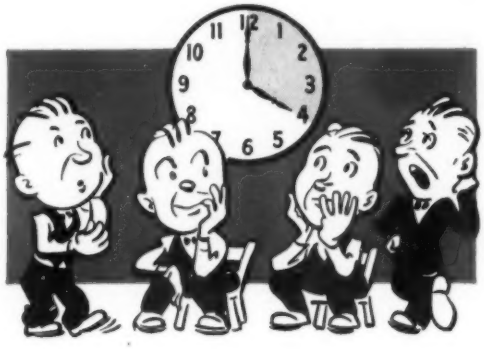
THE PROBLEM of oil leakage from bearings or gear cases, or oil throw-off from rapidly moving parts such as chains or open gears, recurs regularly in practically every plant. The cure is sometimes very simple, such as installing new seals on bearings or gear cases, or using a heavier grade of oil.

But the problem can be complicated, for example, when parts are hard to get, when shut downs to make repairs on machines are out of the question, or where heavier grades of lubricants do not give proper lubrication. In these cases, Stanodrip has solved the problem for many manufacturers.

Excessively heavy lubricants, while they may stop leakage, usually result in overheating, particularly on high speed bearings. Or they may not circulate in gear cases, thus providing little or no lubrication. Stanodrip stops leakage where a regular oil of approximately the same grade will not. Stanodrip contains special additives which resist the tendency to drip or creep, but do not impair its lubricating quality. Let a Standard Oil Lubrication Engineer help you apply Stanodrip to eliminate unsightly, oil consuming, lubricating jobs in your plant. He will be glad to make a test of Stanodrip with you.

Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois, for the Engineer nearest you.

How Stanodrip saves lubricant, maintenance, and production time



Saves 4 hours time of 4 operators each month. In a St. Louis plant every clutch failure on a bomb-nosing machine tied up the machine for four hours, losing the time of four operators and costing $80 for replacements. In spite of the fact that a number of lubricants were tried, clutch faces had to be replaced at least twice a month on each of the three machines. It was about decided that there was no way out of the predicament. Then a Standard Lubrication Engineer suggested a test of Stanodrip because of its ability to stay on the plates and reduce wear. As proof that it did, there have been no clutch failures on the three machines in the first two months' operation.

Saves half the lubricant and all of the cutting oil. Dilution of the cutting oil by the bearing lubricant on a battery of old screw machines in a Michigan plant made it necessary to change many batches of cutting oil long before they were used up. When the straight mineral oil that was used on the bearings was replaced by Stanodrip, lubricant consumption was cut in half and cutting oil dilution practically eliminated.

Stanodrip

Buy more War Bonds

STANDARD OIL COMPANY (INDIANA)

STANDARD SERVICE

* LUBRICATION ENGINEERING

2 New Members of the JKS DIAMOND WHEEL Family

TYPE D11B
FLARING CUP
For general tool and cutter grinding

TYPE 660B
SHALLOW DISH WHEEL
For unusual form grinding

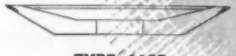
One of these new wheels, Type D11B, is designed for economical general tool and cutter grinding. The other, Type 660B, does an unusual form grinding job.

Features: Wheel shapes provide maximum clearance plus a minimum of contact area between wheel and work. With diamond section mounted on the periphery of the core, as shown in illustration, only inside of core requires dressing as diamond section wears away. Core may be easily cut away with dressing stick.

The flaring cup wheel, Type D11B, is made in three resin bonds: BD bond for fine carbide tipped reamer flute grinding; BC bond for intermediate size carbide tipped cutter; and BV bond for larger cutters and heavy stock removal. Manufactured in sizes 3, 3¾ and 5 in.

The shallow dish wheel, Type 660B, maintains its accuracy throughout use in the sharpest corners. Recommended for the Wickman Grinder. Standard size, 6 in. diameter. Available in three bonds.

TYPE D11B



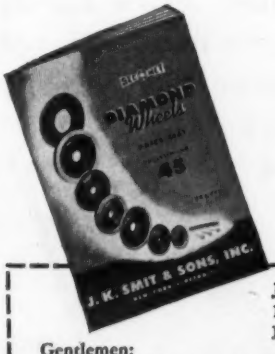
TYPE 660B

Fill in the Coupon

J. K. SMIT & SONS, Inc.

157 Chambers St., New York 7, N.Y. 6400 Tireman Ave., Detroit 4, Mich.

DIAMOND WHEELS • TOOLS FOR DRESSING WHEELS • CORE BITS • METAL WORKING TOOLS • POWDER



J. K. SMIT & SONS, Inc.
157 Chambers Street
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Gentlemen:

☐ Please send prices of Types D11B and 660B wheels. We use approx. (quantity)_____

☐ Send NEW Diamond Wheel Bulletin No. 45

Name_____ Title_____

Company_____

Street_____

City_____ State_____

One of the Handiest....

"Yessir, this Midwest Counterbore Set is one of the handiest things we have around the plant... ...You know why?"

Cutaway View Counterbore Assembly

"They come in a nice, substantial wooden case, each tool with a spot of its own. They're kept in good condition that way—no chipping and banging around they're apt to get in tool cribs. The right tool's handy when you need it—you're not delayed in locating it. And the cutters are easily interchangeable; they can be reground quickly. You'll like this counterbore set, too."

A copy will be sent promptly on request

Set No. 2 as Illustrated Contains:

3 Holders. 22 Counterbores: dia's 1/16"-1 7/8", in steps of 1/16". 2 Countersinks: 7/8" dia. with included angles 60° and 82°. 7 Pilots: 5/16"-11/16", for Counterbores 1/16"-3/4". 11 Pilots: 3/8"-1", for Counterbores 13/16"-1 1/8". 11 Pilots: 1/2"-1 1/8", for Counterbores 1 3/16"-1 3/8". 14 Pilots: 5/8"-1 1/2", for Counterbores 1 7/16"-1 3/4". 12 Pilots: 3/4"-1 1/2", for Counterbores 1 13/16"-3 1/2". Replacement or additions for the set can be made from factory stocks.

Midwest Tool

CARBIDE TIPPED TOOLS • MILLING CUTTERS • FORM TOOLS COUNTERBORES • EXPANSION REAMERS • RECESSING TOOLS CORE DRILLS • SLEEVES • ADJUSTABLE HOLDERS

MIDWEST TOOL & MFG. CO.
2356 W. JEFFERSON AVE., DETROIT 16, MICH.

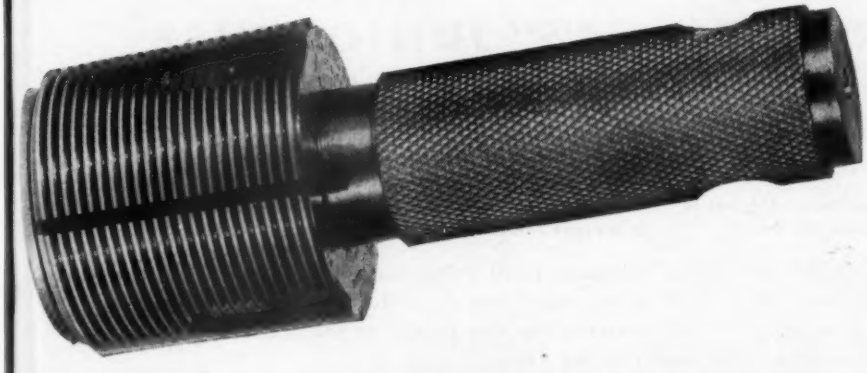
Makers of Fine Tools Since Nineteen Eleven

Here you'll find ACCURACY...

The privilege of imprinting the API monogram on gages, signifying conformance with American Petroleum Institute standards of precision, is not freely or loosely granted.

The Pipe Machinery Company has proudly enjoyed that permission for many years.

You can always rely on the sustained accuracy and perfection of finish of any gage that carries the PM Diamond Emblem.



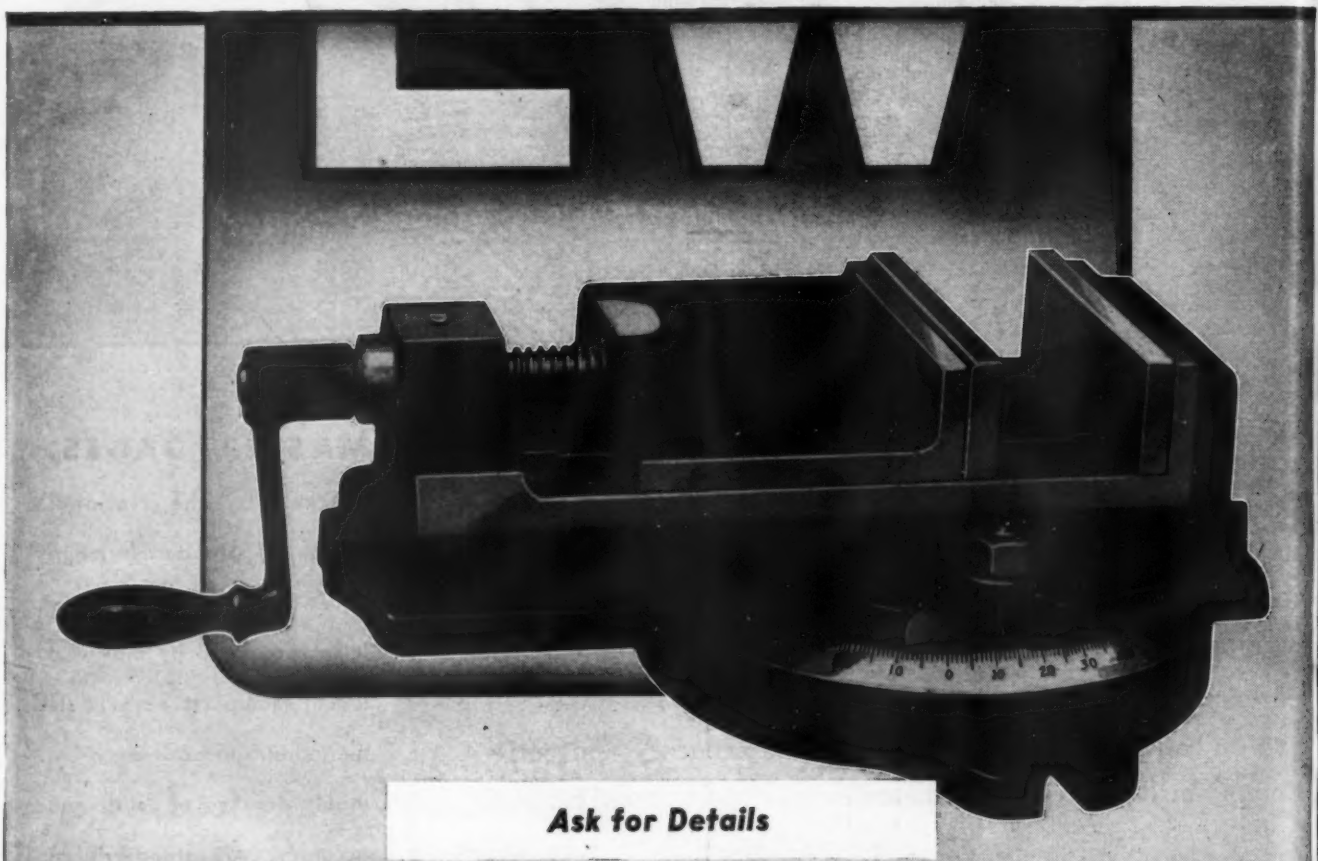
Special Gages, made to your specifications, will be quoted on request. Large stocks of standard Plug, Ring and Thread Gages are ready for immediate shipment.

MASTER GAGES, checked by the National Bureau of Standards, maintained in all important petroleum areas and by pipe and tubing manufacturers, enable the industry to achieve an unusual degree of sustained accuracy. API standards of thread precision are considered the most exacting required in volume production, and the plan for maintaining these standards is without competition in excellence.

The PIPE MACHINERY COMPANY Cleveland, O.

GAGES • MULTIPLE THREAD MILLING CUTTERS • SPECIAL TOOLS

SWIVEL BASE MILLING MACHINE VISE



Ask for Details

6½" MASTER VISE
$32.55

- Graduated Base—can be used plain or swivel
- Width of Jaws, 6½ inches
- Depth of Jaws, 2 inches
- Opens with Steel Jaws, 4 inches—without, 5¼ inches
- Weight complete with crank, boxed, 90 lbs.

4½" JUNIOR VISE
$23.60

- Graduated Base, can be used either plain or swivel
- Width of Jaws, 4½ inches
- Depth of Jaws, 1¾ inches
- Opens with Steel Jaws, 3 inches—without, 3½ inches
- Weight complete with crank, boxed, 50 lbs.

These sturdy vises are ideally suited to Milling Machine, Drill Press and Shaper Jobs. The vise jaws are hardened steel and the large Acme steel screw contributes durability to both the large and small vise. Four bolt and key slots are provided to attach the vise rigidly to the machine table, so that work holding surfaces are at true right angles to the table.

Send for complete catalog giving prices and specifications on these quality, low-cost L-W Products

L-W CHUCK COMPANY 5 N. ST. CLAIR ST. TOLEDO 4, OHIO

OUR KEYS TO RE-CONVERSION

Maybe it's a job of retooling for all-out action in the Pacific . . . but reconversion or retooling, Quality control holds the secret of mass production. These four gage data sheets are ready to go into the mail or come to you by way of a VARD service representative. Ask for them direct or from the nearest VARD dealer. You'll want them in your files and in your production control offices.

VARD GAGE SERVICE ACROSS THE CONTINENT

INGHAM, ALABAMA
Engineering Service

ANGELES, CALIF.
hinists' Tool & Supply Co.

FRANCISCO, CALIF.
las & Sturgess

VER, COLORADO
son Supply Company

GEPORT, CONNECTICUT
el-Nagel Tool Supply Co., Inc.

NTA, GEORGIA
n Supply Co.

CAGO, ILLINOIS
Equipment Co.

ANAPOLIS, INDIANA
Tool & Engineering Co.

MOINES, IOWA
e Machinery & Supply Co.

HITA, KANSAS
e Star Machinery & Supply Co.

ORLEANS, LOUISIANA
ay-Baker-Frederic, Inc.

OIT, MICHIGAN
Taylor Company

KEGON HEIGHTS, MICHIGAN
A. Industrial Service

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KANSAS CITY, MISSOURI
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NEW YORK, N. Y.
Walter D. Briggs Co.

ROCHESTER, NEW YORK
The Sidney B. Roby Co.

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CLEVELAND, OHIO
Mark E. Moffett

TOLEDO, OHIO
Klatt & Wood Machinery

OKLAHOMA CITY, OKLAHOMA
Hart Industrial Supply Co.

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Hart Industrial Supply Co.

PORTLAND, OREGON
The General Tool Co.

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Carlin & Company

PITTSBURGH, PENNSYLVANIA
A. D. "Bert" Sutherland

YANKTON, SOUTH DAKOTA
Dakota Supply Co.

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Hays Machine Tool Co.

DALLAS, TEXAS
Tool Supply & Engineering Co.

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SALT LAKE CITY, UTAH
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VARD INC.
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VARD stands for Verity · Accuracy · Responsibility · Durability

For your information:

Engineering Data
on
Precision Broaching Tools

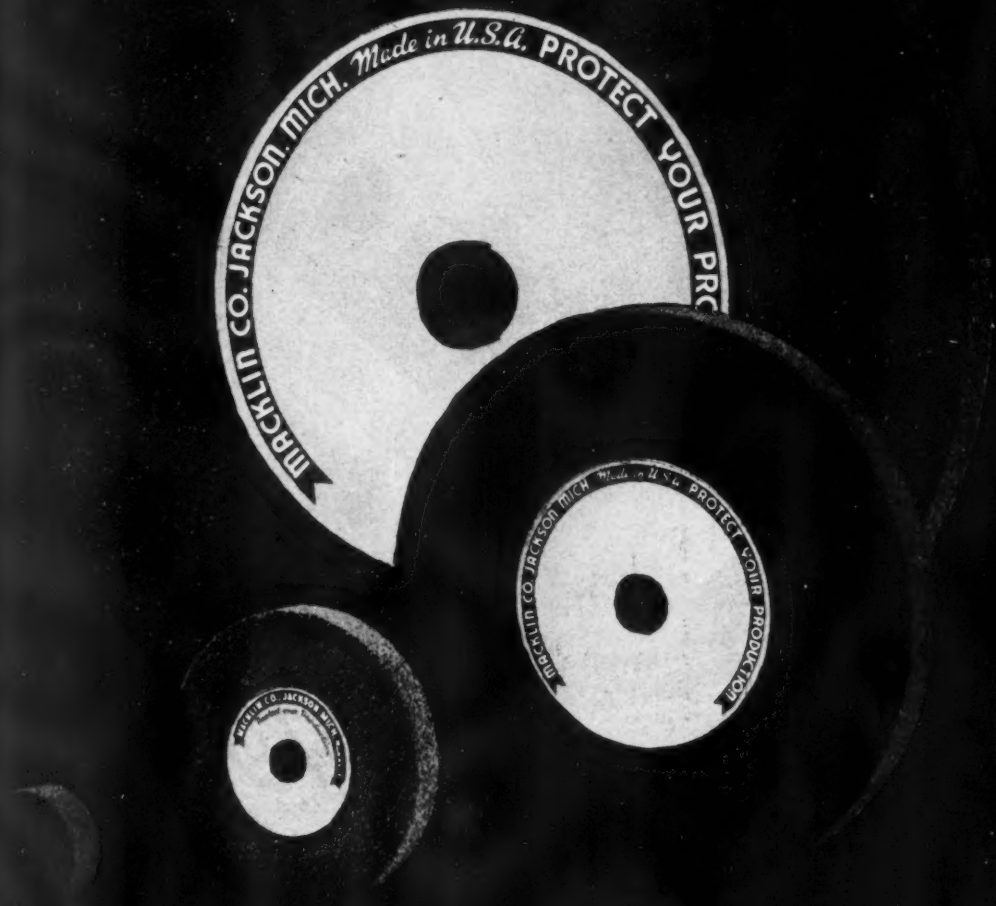
YOU will want this Brochure because it contains technical information about broaching tools plus a picture story (in natural color) showing how they are manufactured. If you are planning for post-war production it will more than pay you to send for your free copy today. Please make request on your company stationery.

REMEMBER: Broaching is the fastest metal cutting process that roughs and finishes to precision limits.

U.S. BROACH Company

USB — 6464 E. SEVEN MILE ROAD — DETROIT 12, MICH. — BROACHING TOOL

TELEPHONE TWINBROOK 1-2211



MACKLIN GRINDING WHEELS.

"PROTECT YOUR PRODUCTION" with Macklin High Quality Wheels—made from the smallest to the largest—in all grains and grades, for every grinding purpose.

Ask for the services of a Macklin field engineer

MACKLIN COMPANY

Manufacturers of GRINDING WHEELS — JACKSON, MICHIGAN, U. S. A.

Distributors in all principal cities

Sales Offices: — Chicago - New York - Detroit - Pittsburgh - Cleveland - Cincinnati - Milwaukee - Philadelphia

Wide usage IS BUILDING PREFERENCE

Gorham HIGH SPEED STEEL TOOL BITS

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GORHAM STANDARD
FOR THE COMMERCIAL FIELD

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GORHAM M-40-B
FOR HEAVY CUTS IN HARD MATERIAL

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FOR MORE ABRASIVE MATERIALS

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The range of applications keeps widening which in turn creates a greater demand for GORHAM Tool Bits. Industry returns again and again for these high speed steel tool bits because of their superior quality. Our long experience in the selection and heat treatment of materials proper for the work the particular bit is called upon to do makes possible these "production tools that perform." Get all facts today on this line which is building such a reputation for quality and performance. We can ship from stock and make quick deliveries also on special sizes and shapes.

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☆ 14400 WOODROW WILSON AVENUE ☆

DETROIT 3, MICHIGAN

Announcing

NATIONAL "HELEX"

FAST SPIRAL END MILLS

For Higher Speeds, Efficient Operation

NATIONAL "Helex" End Mills are designed for milling slots, keyways and pockets, where the ordinary arbor type of milling cutter cannot be used.

The high helix angle of the cutting edges, and the general free cutting construction of these end mills, promote smooth, efficient operation even at high speeds. High speeds are recommended, especially for the smaller diameter cutters, because they avoid feed overloads and consequent breakage.

Ask your National distributor for complete information on "Helex" End Mills or write direct for free 16-page "Helex" booklet.

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Leading distributors in every section of the country carry National Cutting Tools. National distributors offer factory trained engineers to serve you. Call your National distributor for cutting tools or any staple industrial product.

NATIONAL

NATIONAL TWIST DRILL & TOOL ROCHESTER, MICH., U.S.A.

TWIST DRILLS
REAMERS, HOBS
MILLING CUTTERS
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SPECIAL TOOLS

TWIST DRILL AND TOOL COMPANY

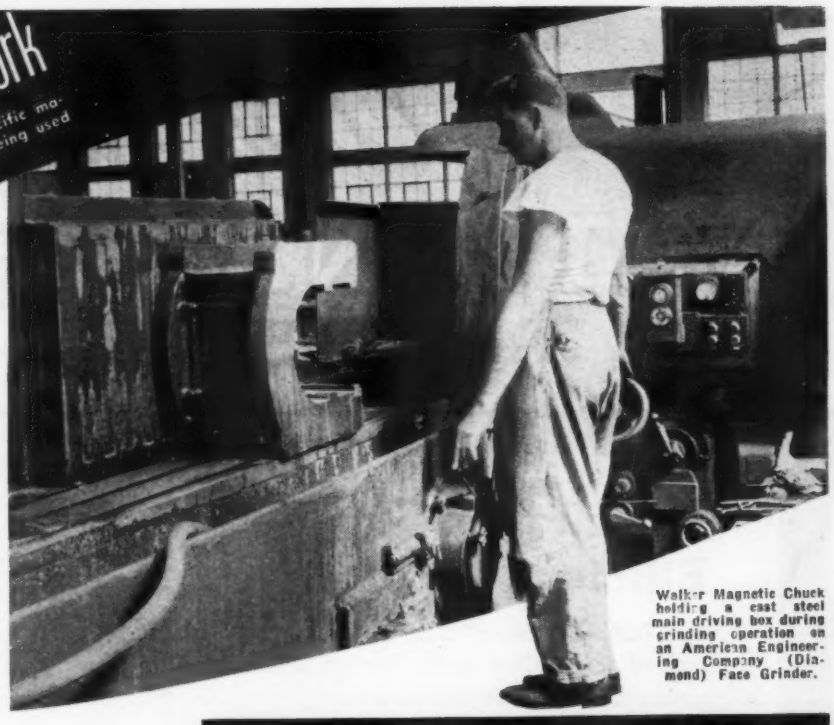
DETROIT AND ROCHESTER, MICHIGAN

Tap and Die Division—Winter Brothers Co., Wrentham, Mass.

Factory Branches • New York • Chicago • Cleveland • San Francisco • Distributors in Principal Cities

"WALKERS" at work

One of a series of advertisements showing specific machines on which Walker Magnetic Chucks are being used and the operations being performed.



Walker Magnetic Chuck holding a cast steel main driving box during grinding operation on an American Engineering Company (Diamond) Face Grinder.

AMPLE HOLDING POWER ASSURED FOR HEAVY WORK

The fine finish and the savings in material and time made available by face grinding are assured by the use of Walker Magnetic Chucks. The American Engineering Company, recognizing the holding power of "WALKERS," installs these modern holding devices on their machines.

Walker Magnetic Chucks are available in types to meet today's and tomorrow's requirements in production and tool room. Recent Walker developments include Bar and Longitudinal Electro-Magnetic Chucks of new design and Permanent Magnetic Chucks in Plain and Swivel types. Ask us for details and consult your machine tool builder on your problem.

O. S. Walker Co., Inc.
201 ROCKDALE STREET
WORCESTER 6, MASSACHUSETTS

HARDNESS TESTER

Let the SCLEROSCOPE speed up the production of that s so we can blow the Axis to HELL

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9025 VAN WYCK AVENUE
JAMAICA, NEW YORK
TELEPHONE: JAMAICA 6-4090

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With a MODEL "J" HAND TACHOMETER

Triple Range:
300— 1200 R.P.M.
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RUGGED-RELIABLE-CONTINUOUSLY INDICATING TYPE

WRITE FOR BULLETIN #706

HERMAN H. STICHT CO. INC.
27 PARK PLACE NEW YORK, N. Y.

A.B.C. DRILL JIG BUSHINGS

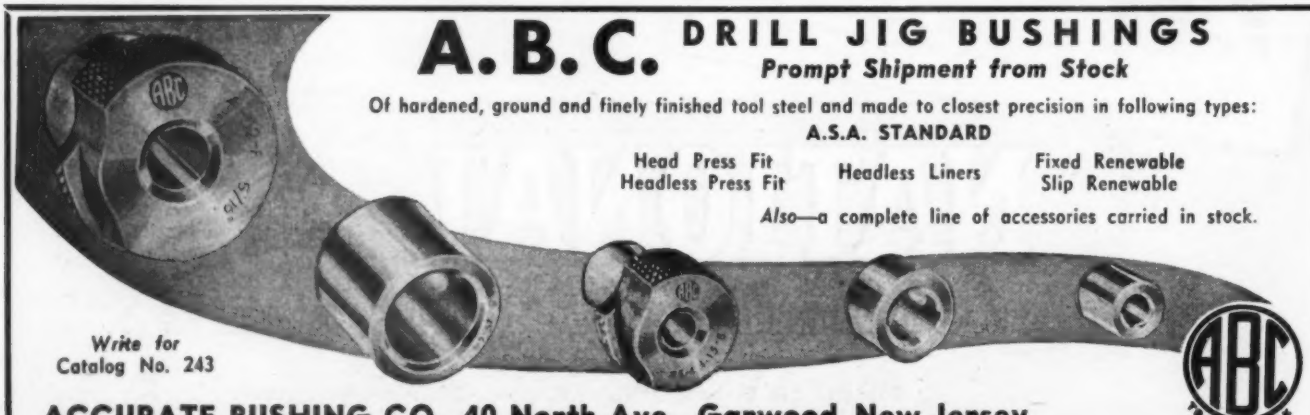
Prompt Shipment from Stock

Of hardened, ground and finely finished tool steel and made to closest precision in following types:

A.S.A. STANDARD

Head Press Fit
Headless Press Fit
Headless Liners
Fixed Renewable
Slip Renewable

Also—a complete line of accessories carried in stock.



Write for Catalog No. 243

ACCURATE BUSHING CO., 40 North Ave., Garwood, New Jersey

WHEN THE FLAMES DIE DOWN OVER THERE— what happens over here?

MERITS OF ALLEGHENY METAL

- ★ Great strength, retained at extremes of heat and cold.
- ★ Tough and impact-resistant.
- ★ Favorable strength-weight ratio.
- ★ Highly corrosion-resistant.
- ★ Inherent, lasting beauty.
- ★ Easy to form and weld.

ON one thing we're all agreed—the lights of industry in this country must die down as little and as briefly as possible, in the turn-back to peace. Getting tools and dies ready—knowing how you'll start, what products you'll make, what materials you'll need—those are patriotic as well as economic necessities *now,* without taking away at all from the first importance of the war.

In working your problems of redesign and new design, when you come to the matter of materials, that's where we can be of help. Remember that the function of Allegheny Metal, pioneer stainless steel in America, is always to *improve:* strength, service life, cleanliness, appearance—whatever means most to you.

Call on us for any assistance you need—either in the use of Allegheny Metal or any of our other special alloy steel families: tool and die, electrical, valve or nitriding steels.

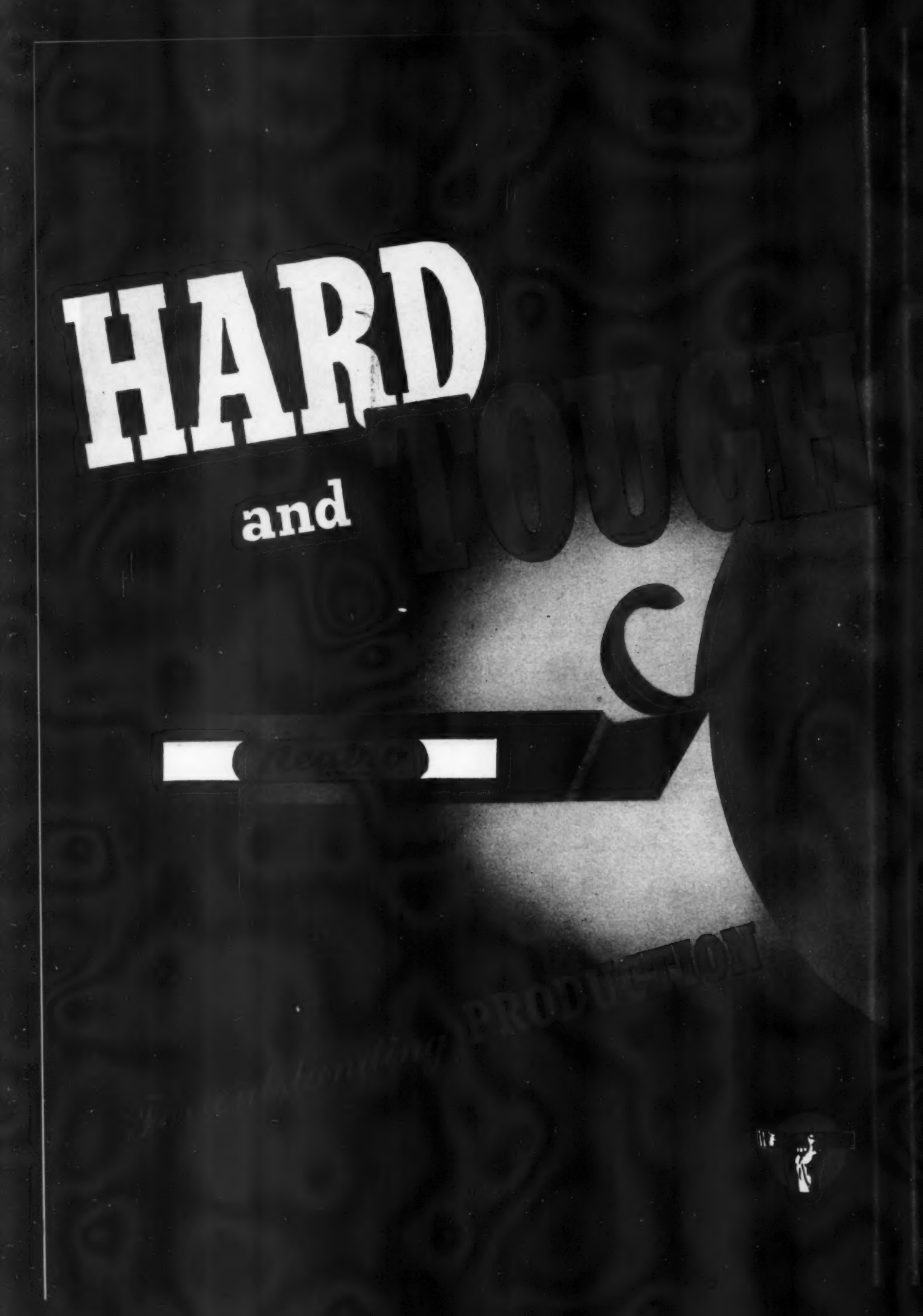
Allegheny Ludlum Steel Corporation
Brackenridge, Pennsylvania

ALLEGHENY METAL
The Time-Tested Stainless Steel

W&D 9495 D

ALSO HANDLED AND STOCKED BY ALL JOSEPH T. RYERSON & SON, INC. WAREHOUSES

HARD and TOUGH



Cut tomorrow's problems

DOWN TO SIZE

with

NEATRO

In Neatro there is combined high hardness and high toughness with unusually high wear resistance beyond that of other high speed steels and so outstanding as to be readily observed even in grinding. These properties make Neatro particularly useful for machining plastics, cast steels, cast iron and heat treated materials.

Neatro is suitable for all types of tools including milling cutters, form cutters, counterbores, hobs, broaches, drills, reamers, taps, chasers and all single point tools.

Vanadium-Alloys STEEL CO.

LATROBE, PA.

COLONIAL STEEL DIVISION ★ ANCHOR DRAWN STEEL CO.

GAGES OF PRECISION BY WOODWORTH

ALL the facilities of the N. A. Woodworth Company are directed to one objective . . . the manufacturing of precision gages and tools with the longest accurate life to give the user the lowest possible operating cost.

Increase your production efficiency with sustained accuracy by Woodworth.

* * *

1 Speed up production and reduce costs with the Limitrol. The Limitrol Comparator Type Snap Gage checks errors involving pitch diameter, lead, taper, angle, out-of-roundness. It eliminates "feel" and reduces scrap. Write for Folder 44-L.

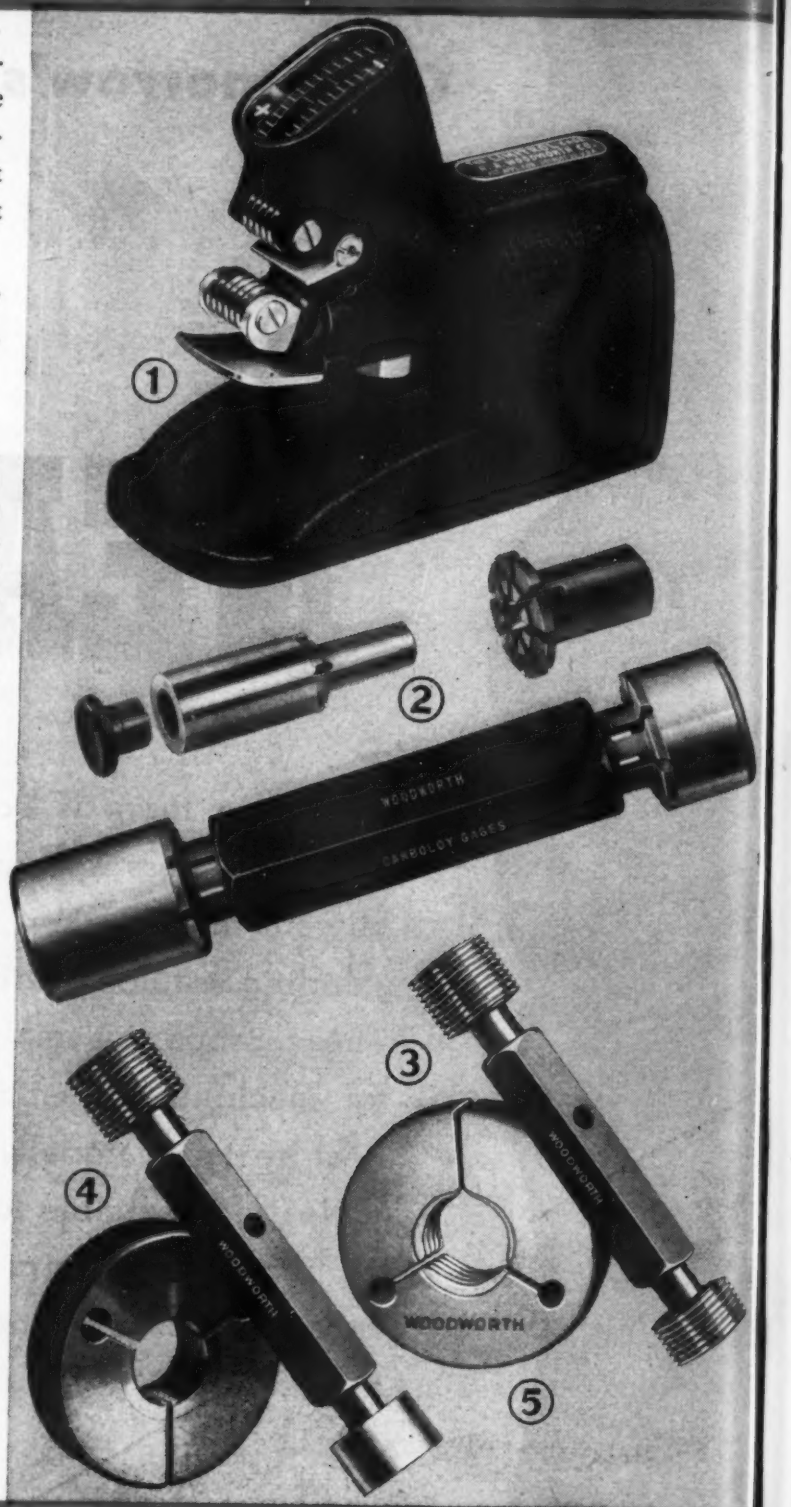
2 Woodworth Carboloy Gages are free from distortions, stresses and strains. Woodworth's exclusive segmented shank compensates for the differences in coefficient of expansion between cemented carbides and steel, thus assuring a trouble-free bond between these two materials. Write for Circular 44-C.

3 Woodworth Durplate Gages are noted for their long life and great accuracy. The Durplate process is exclusively a Woodworth development and confirms the Woodworth slogan, "accuracy you can trust."

4 Woodworth gages of cast Stellite alloy are tough, high wear-resistant . . . have a service life many times that of steel. Gage life is increased from 10 to 20 times. Stellite Cast Alloy Gages are non-corrodible and non-magnetic . . . have a coefficient of expansion close to steel... with other desirable characteristics. Write for Folder 44-S.

5 Gages of Nawlide, a specially processed Woodworth alloy, are outwearing ordinary steel gages many times with no sacrifice in toughness.

ACCURACY YOU W CAN TRUST



WOODWORTH

N. A. WOODWORTH CO., SALES DIVISION, 1300 E. NINE MILE ROAD • DETROIT 20, MICHIGAN

PRECISION GAGES • PRECISION MACHINED PARTS • PRECISION TOOLS

DERAL

Announces-

It Has Taken Over the Exclusive Sale of the

METRICATOR SYSTEM AIR GAGE

Manufactured by —

METRICAL LABORATORIES, INC.
ANN ARBOR, MICH. • EXCLUSIVELY FOR
FEDERAL PRODUCTS CORP.

This very successful system of gaging by air, recently introduced by Metrical Laboratories, as the "Metricator", embodies great magnification with exceptional accuracy, and in a very simple and efficient manner.

One ten thousandth of an inch (.0001") is represented by approximately ½" on the scale. Practically any inside dimension down to ⅛" diameter, outside dimensions down to ¼" in diameter, and other dimensions of depth, width, etc. can be gaged singly or simultaneously.

Pressure variations, moisture, and sludge in the airline do not affect the Gage.

Write for circulars describing this very efficient gaging system.

FEDERAL PRODUCTS CORPORATION
1144 Eddy Street • Providence 1, R. I.

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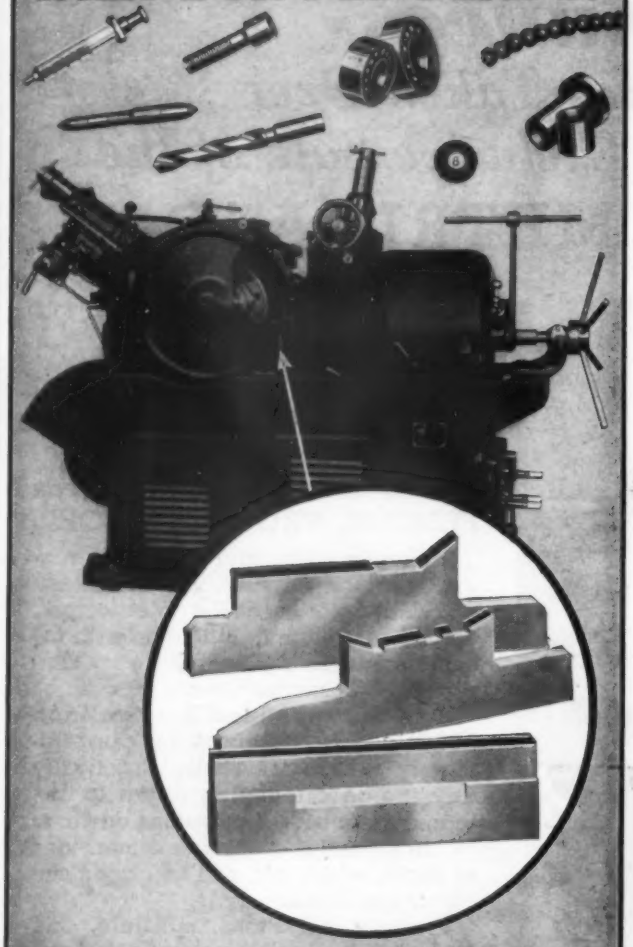
★ ★ ★ ★ ★ FEDERAL

CENTERLESS GROUND *with* TALIDE-TIPPED BLADES



Talide-Tipped Blades, with Tungsten Carbide wear strips, have become standard equipment for centerless grinding armor-piercing shot, shells, projectiles, bullet cores, aircraft parts and other ordnance material

The extra long life of super-hard Talide Blades, plus their natural ability to resist scoring and galling, have helped to increase the production of precision ground parts by eliminating down-time and rejects.

In the post-war period, Talide-Tipped Blades will be used to increase the production of lower cost roller bearings, fountain pens, cap screws, twist drills, bushings and a wide variety of shafts, spindles and screw machine products. Write for catalog 43-WP listing full particulars and prices.

TIPPED WITH TUNGSTEN CARBIDE

METAL CARBIDES CORPORATION TALIDE YOUNGSTOWN, OHIO

METAL CARBIDES CORPORATION
YOUNGSTOWN 5, OHIO
TUNGSTEN CARBIDE TOOLS · DIES · WEAR PARTS

YOU ARE SURE of the Best When You Select from the WYCO CATALOG

There *is* a right machine for every job—WYCO Flexible Shaft Equipment includes a complete range of machines to meet every production requirement . . . with mountings to suit every working condition.

WYCO Flexible Shaft Machines have won national recognition for successful performance on the toughest jobs for war production . . . have set *new records* for longer shaft life and greater production per unit of power!

Send for our Catalog today.

WYZENBEEK & STAFF, INC.
830 W. Hubbard St., Chicago 22, Ill.

MODEL 53-A

Selective Speeds 1800, 3600 or 6000 RPM. 1½ HP 3-phase motor and 7 ft. Shaft. Note low center of gravity—no danger of tipping over.

Only WYCO Flexible Shafts have this Patented Non-Metallic Innerliner—Makes the Core last longer . . . Run smoother . . . Transmit more power.

WYCO FLEXIBLE SHAFT EQUIPMENT and PROFIT PRODUCING TOOLS

UNITED STATES PRODUCTS CO.

LAPPING AND GRINDING COMPOUNDS

• Grade No. 19 •

A SPECIAL COMPOUND FOR BRASS AND BRONZE

PLUG COCK VALVES

Grade No. 19 is a water soluble compound having all the lubricating qualities of those mixed with grease and oil. This compound does not "niggard or score" while grinding or lapping—a common trouble when working with soft metals. No. 19 contains an abrasive that experience has shown to be best suited for grinding and lapping brass and bronze plug cocks. The finished parts can be washed in ordinary water

Generous sample sent upon request.

UNITED STATES PRODUCTS CO.
518 MELWOOD ST. USP Co PITTSBURGH, PA.

A BALANCING ACT

That Makes the Most of Your Grinding Machines

The POPE
Precision Grinder Spindle

It is of vital importance that the Spindle Unit be in perfect balance. Pope Precision Grinder Spindles are designed and constructed to achieve that balance. The finest precision bearings are employed. Every part is finished to extremely close tolerances and Pope Spindles are assembled and tested by skilled specialists. The result is a Spindle free from objectionable vibration and capable of producing exceedingly fine grinding finishes.

This 6" x 18" Surface Grinder Spindle has a sealed-in 1HP motor and carries a 7" or 8" dia. wheel.

The POPE
Balancing Wheel Holder and Balancing Kit

For 6" x 18" Surface Grinders

With the Pope Balancing Wheel Holder and Balancing Kit accurate wheel balance is obtained quickly and easily. Even the best makes of new wheels do not always come through in true balance and unbalance develops in use from a number of causes. The Kit provides a simple, direct balancing procedure so easy to do that there is no longer any temptation to neglect this essential element in fine finishes.

Why not make the most of your grinders? To see how easily and inexpensively it can be done, just ask us to mail you Spindle Data Sheet No. 12 "A" and booklet "How to Get Better Finishes On Ground Surfaces."

No. 24

POPE

POPE MACHINERY CORPORATION

ESTABLISHED 1920

261 RIVER STREET • HAVERHILL, MASSACHUSETTS

BUILDERS OF PRECISION SPINDLES

Pea-Size to Cartwheels

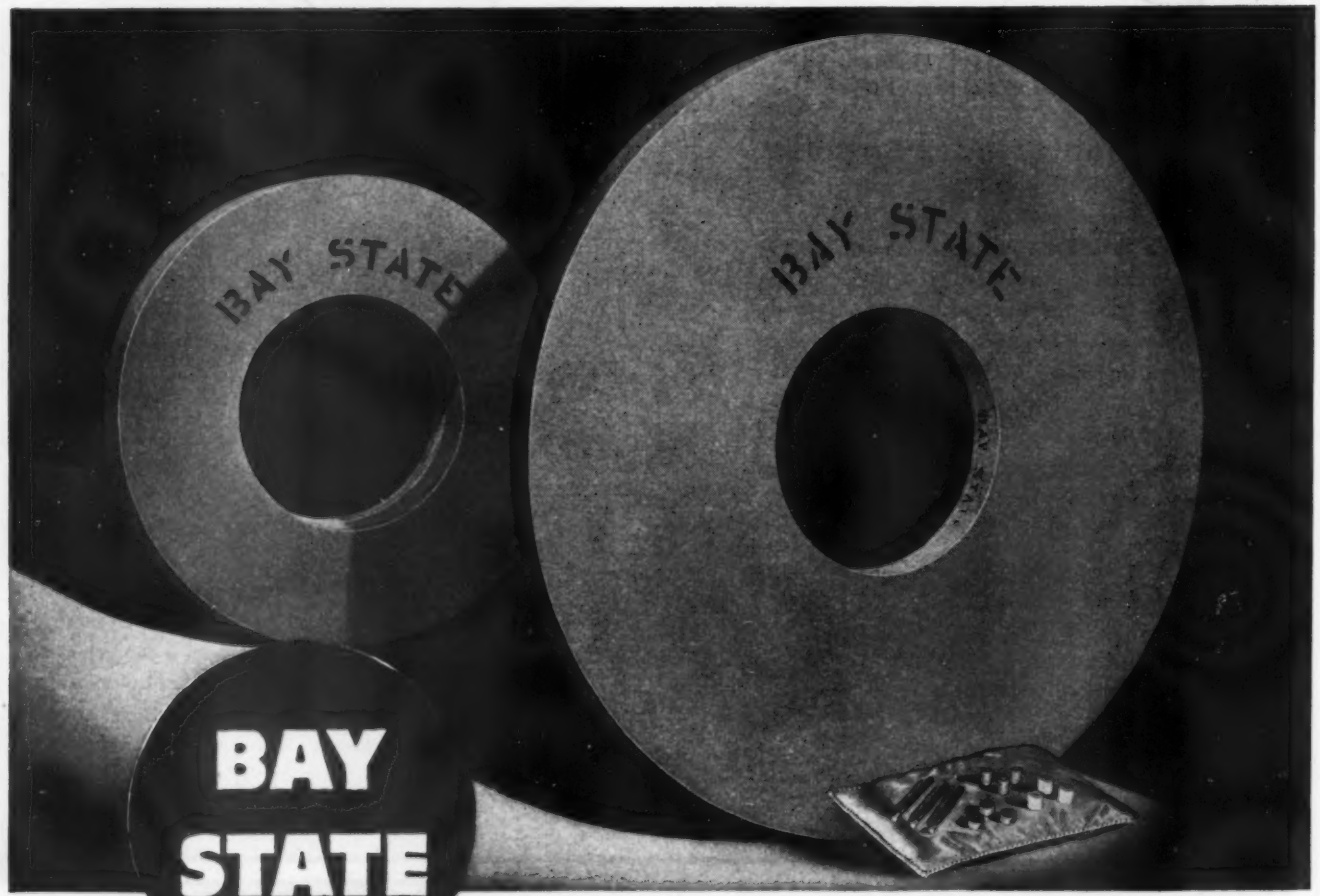
Whether you're looking for a grinding wheel the size of a small pea . . . or even smaller . . . or a 42″ crankshaft wheel . . . you can find it in the Bay State line.

And whatever *specifications* you're demanding . . . in respect to bond, grain, grade, shape or structure . . . a Bay State product can be provided to fill the bill—the first time and *whenever* you require those identical specifications.

Bay State's exclusive "fractional grading", "controlled porosity" and other features make it possible to achieve greater accuracy in meeting specifications on the *original order* and duplicating them exactly on each *re-order.*

Write us for literature on the types of grinding wheels you use.

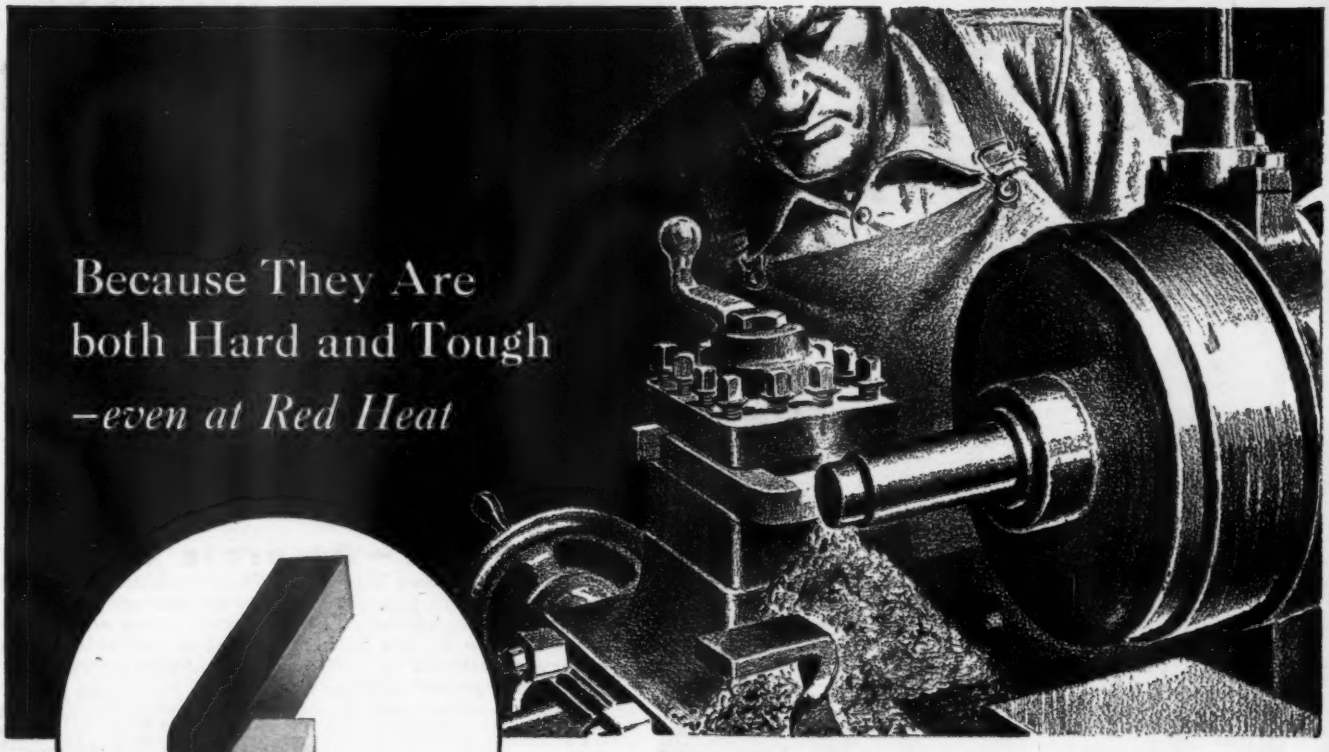
BAY STATE ABRASIVE PRODUCTS CO.
1 Union Street, Westboro, Mass.



ABRASIVE PRODUCTS

Top Performance Consistently Duplicated

GRINDING WHEELS · HONING AND SUPERFINISHING STONES · PORTABLE SNAGGING WHEELS
MOUNTED WHEELS AND POINTS · CUT-OFF WHEELS · INSERTED-NUT DISCS AND CYLINDERS



Because They Are
both Hard and Tough
—even at Red Heat

One style of HAYNES STELLITE tipped tools.

HAYNES STELLITE alloys are good materials for high-production metal-cutting tools

• Metal-cutting tools of HAYNES STELLITE cobalt-chromium-tungsten alloys are especially economical when high speeds with heavy feeds and deep cuts are required. With these tools manufacturers have made marked savings in time and in cost per piece machined where cutting tools cannot be "babied."

The same properties that make these HAYNES STELLITE alloys so useful in metal-cutting tools are also required in many other industrial applications where hard, tough, abrasion- and corrosion-resistant materials are needed. Our engineers can help you use the alloys economically and effectively. Write for further information.

Some Advantages of HAYNES STELLITE Alloys

1. Resistance to wear and abrasion.
2. Hardness even at red heat.
3. Good mechanical properties at high temperatures over long periods of time.
4. Resistance to atmospheric corrosion and corrosive chemicals.
5. Low coefficient of friction.
6. Practically non-magnetic.
7. Available in the form of castings, small sheets, and welding rod.

BUY UNITED STATES WAR BONDS AND STAMPS

HAYNES STELLITE TRADE-MARK

HAYNES STELLITE COMPANY

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ARMY E NAVY

• HIGH-PRODUCTION METAL-CUTTING TOOLS •

"Haynes Stellite" is a registered trade-mark of Haynes Stellite Company.

CRITERION *Boring* HEADS

Featuring EXTREMELY **RIGID** *Construction*

Criterion Boring Heads are particularly adapted to the use of carbide tools due to their extremely rigid construction. Their accuracy, utility, and interchangeable feature rate the highest praise from operators everywhere. Lead Screw ground from solid AFTER hardening. Order from your dealer. Request free literature.

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MACHINE WORKS
BEVERLY HILLS, CALIFORNIA

PALMGREN
ANGLE VISES

HEAVY-DUTY Model

For Quick — Accurate Set-ups

PALMGREN Heavy Duty Angle Vises are built sturdy and rugged for tough, heavy jobs. They are accurately graduated in degrees, can be quickly adjusted to any angle, stay locked under severe service and save valuable hours otherwise wasted in tedious make-ready, wedging or making temporary jigs and fixtures.

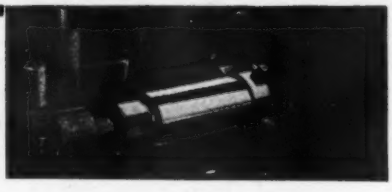
Jaws are hardened and ground. Special outstanding features are the size and opening of jaws—4" Jaws open full 4"; the 6" Jaws open full 6" etc., with corresponding depth of Jaws. Vise can be used as ordinary vise when lowered to horizontal position. Swivel bases furnished if desired. Sizes 4", 6" and 8" Jaws and openings. Prompt deliveries.

Write for Circular 347

CHICAGO TOOL & ENGINEERING CO.
Mfrs. of PALMGREN PRODUCTS for over 26 years
8354 SOUTH CHICAGO AVE. . . . CHICAGO 17, ILL.

PRECISION WORK AT ANY ANGLE

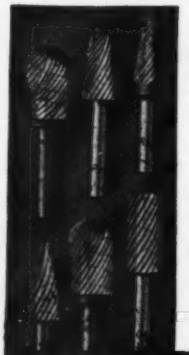
SAVE
Setting-Up Time with



NICHOLSON EXPANDING MANDRELS

Set of 19 of these economy, precision tools does the work of 193 solid arbors. Hardened tool steel. 2 types, all sizes. Sold singly or in sets. Prompt delivery. Bulletin 1043.

W.H. NICHOLSON & CO., 114 Oregon St., Wilkes-Barre, Pa.



Grobet
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Hand Cut • Milled Cut Ground from the Solid

There is a GROBET ROTARY FILE in shape, size and coarseness of cut for every type of hard or soft metal, plastic, wood, etc. GROBET FILES do their jobs better and stay sharp longer.

Send for catalog DR, the most complete of its kind illustrating and describing GROBET Rotary Files, Diesinkers, Burs, Tube Burring Cutters, Chatterless, Countersink, etc.

GROBET FILE CO. of AMERICA

421 Canal Street — **New York, 13 N. Y.**

IMPORTERS OF GROBET SWISS FILES — MFRS. OF GROBET ROTARY FILES

Plants: New York • Chicago • Los Angeles

How a Disstoneer Solved the case of the Plastic Board

An aircraft manufacturer had a tough problem—cutting 2" thick sheets of plastic material into parts for panel boards. A 14" solid tooth circular saw, with straight-front, carbide-tipped teeth had been recommended by someone else. There were 36 teeth in the saw. This saw caused the material to feed hard, and often scorch. After a short time the operator was ready to quit.

A Disstoneer*, who studied the problem, recommended an alternate top and face bevel, carbide-tipped tooth, inserted section saw with 84 teeth. Greater production resulted, scorching was eliminated, and there was less fatigue for the operator.

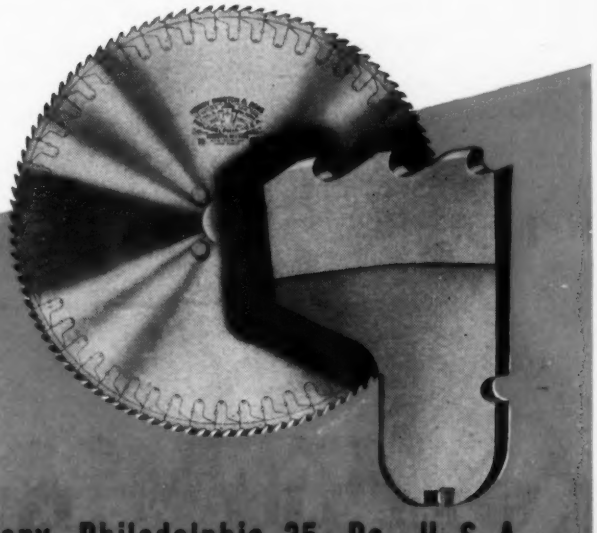
***DISSTONEER**—a man who combines the experience of Disston leadership and sound engineering knowledge, to find the *right tool* for you—to cut metal, to cut wood and other materials—and TO CUT YOUR COST OF PRODUCTION—*not only on special work, but on ordinary jobs as well.*

Another clear-cut case of Disston leadership!

You may never have occasion to cut a plastic of this character, but there may be other cutting problems in your plant that can be correctly solved by the use of one or more items in our line of

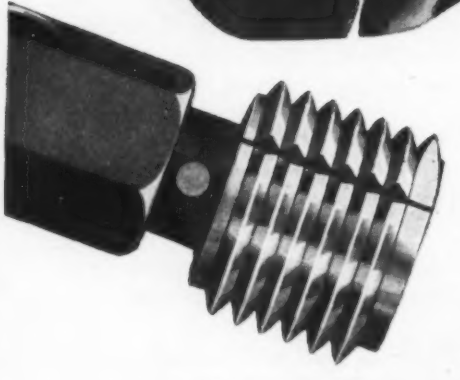
DISSTON STEEL SPECIALTIES

These Disston Steel Specialties cover a wide range of products—cutters of various types, knives, machine scraper blades, perforators, slitters, liner plates, wearing plates, slotters, etc. Among these specialties, you may find the exact tool to meet some definite need now confronting you. Write for full particulars.



HENRY DISSTON & SONS, INC., 620 Tacony, Philadelphia 35, Pa., U. S. A.

That Unseen Extra Quality



A Golf Champ has it— The NEW V-nide has it

You can't see that Unseen Extra Quality but it's there, in each gage, forcing the "Cost per hole gaged" down and down. Actual production tests on cast aluminum have shown up to 13.4 times more wear than tool steel gages. See what they'll do for you. Available in "W" tolerance.

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GAGES OF LONG LIFE ACCURACY

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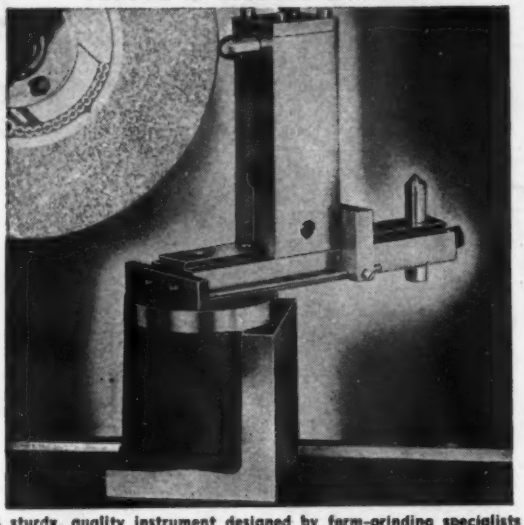
ANGLE & RADIUS DRESSER



A sturdy, quality instrument designed by form-grinding specialists to dress BOTH angles and radius at low cost. Two 1/3 ct. diamonds and case included—$150.00 complete.

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Large range	.0001" accuracy obtainable
Chatterless	Simple to operate
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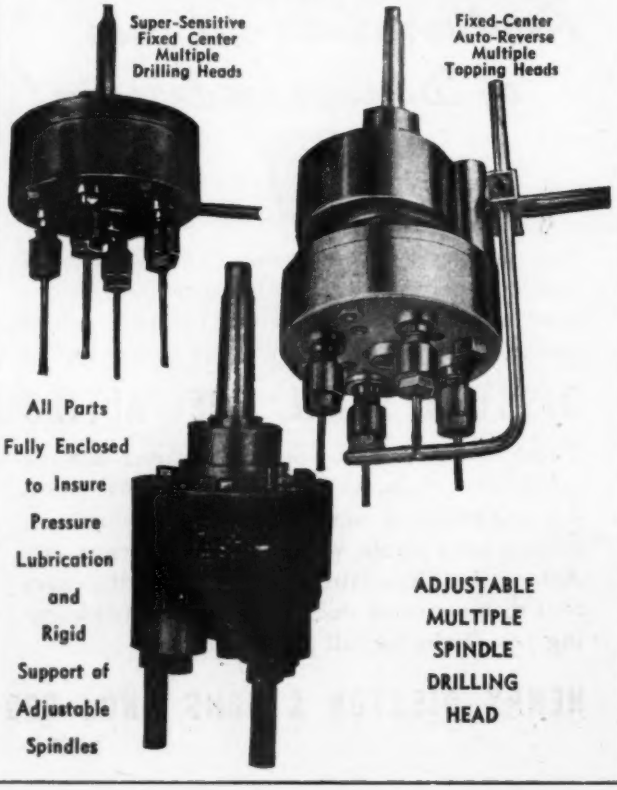
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Fixed-Center Auto-Reverse Multiple Tapping Heads
All Parts Fully Enclosed to Insure Pressure Lubrication and Rigid Support of Adjustable Spindles
ADJUSTABLE MULTIPLE SPINDLE DRILLING HEAD

Headquarters FOR SPECIAL TOOLS FOR SPECIAL NEEDS

Photographs by courtesy of The Timken-Detroit Axle Co.

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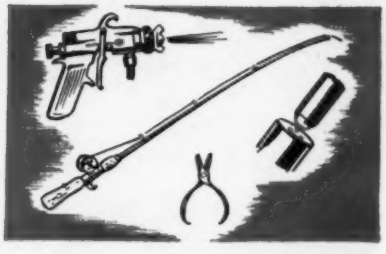
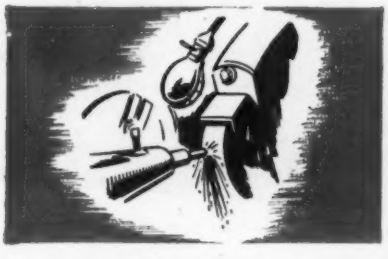


Improve the products you SELL, by "wearproofing" vital parts with carbides for extra-long life.

Keep machine maintenance costs *DOWN*, production *UP*, with carbide-tipped parts.



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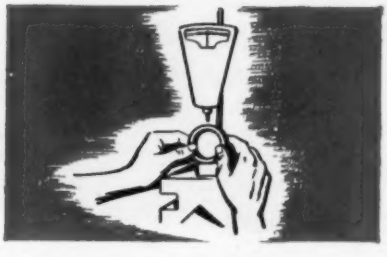

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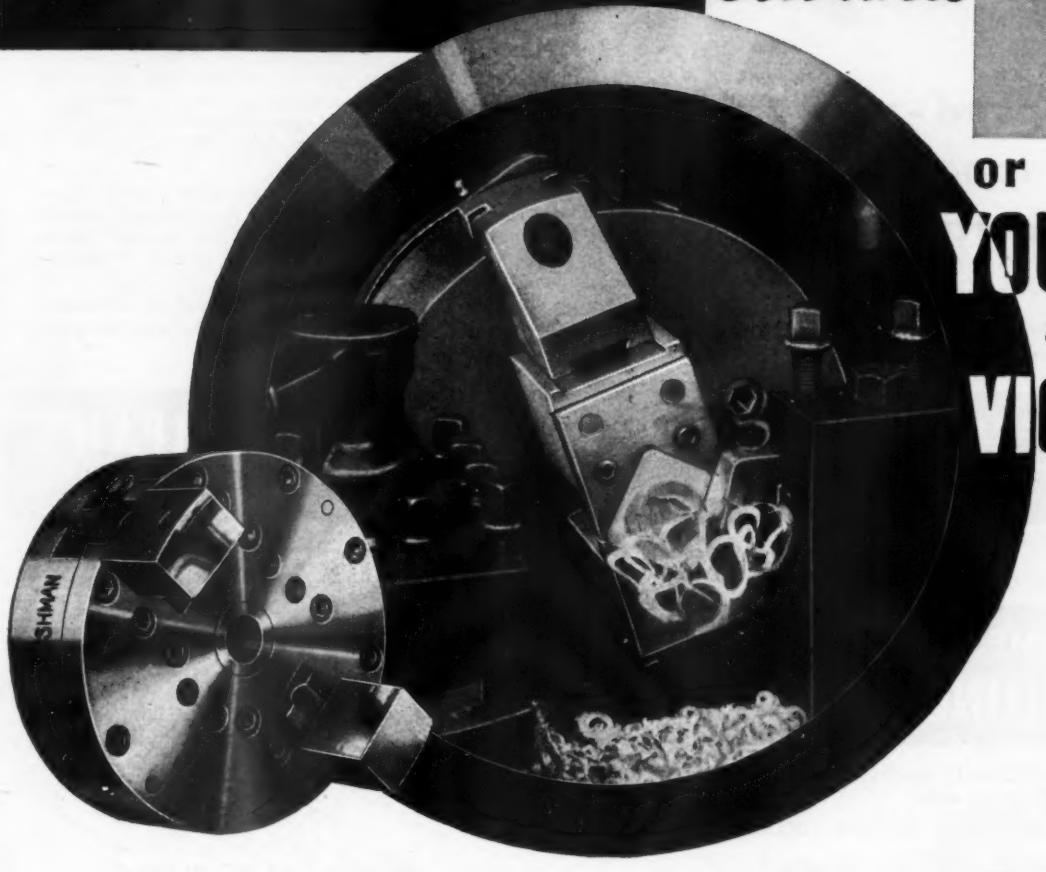
whether your plant enters the post-war competition...

old and tired

or

YOUNG and VIGOROUS



Today you are driving hard for production to speed victory. And that means that every piece of equipment in your shop is wearing out faster than most shop men considered possible a few years ago. Unless you, Mr. Manufacturer, are fully aware of this fact . . . and are prepared to do something about it . . . you may enter the period of post-war competition with a plant that is old and tired rather than one that is young and vigorous to meet tomorrow's challenge.

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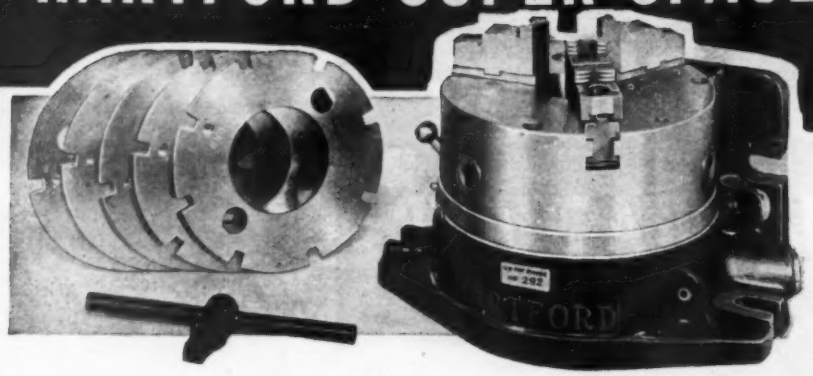

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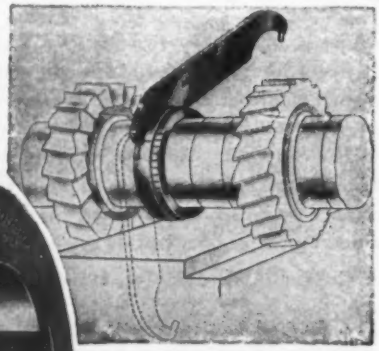
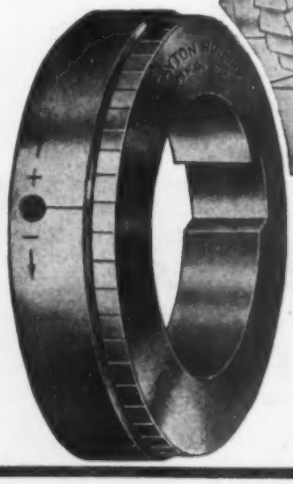
DAYTON ROGERS ADJUSTABLE SPACING COLLARS

Just loosen cutter arbor nut and make plus or minus adjustment with handy wrench as shown.





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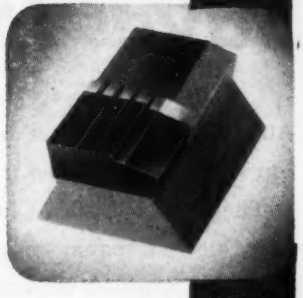

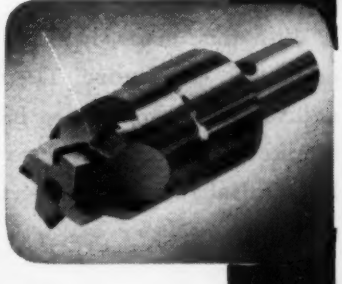

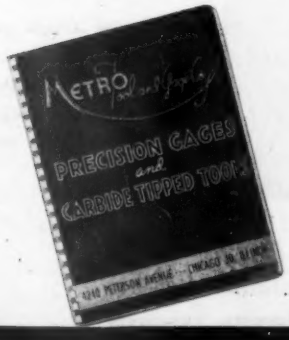

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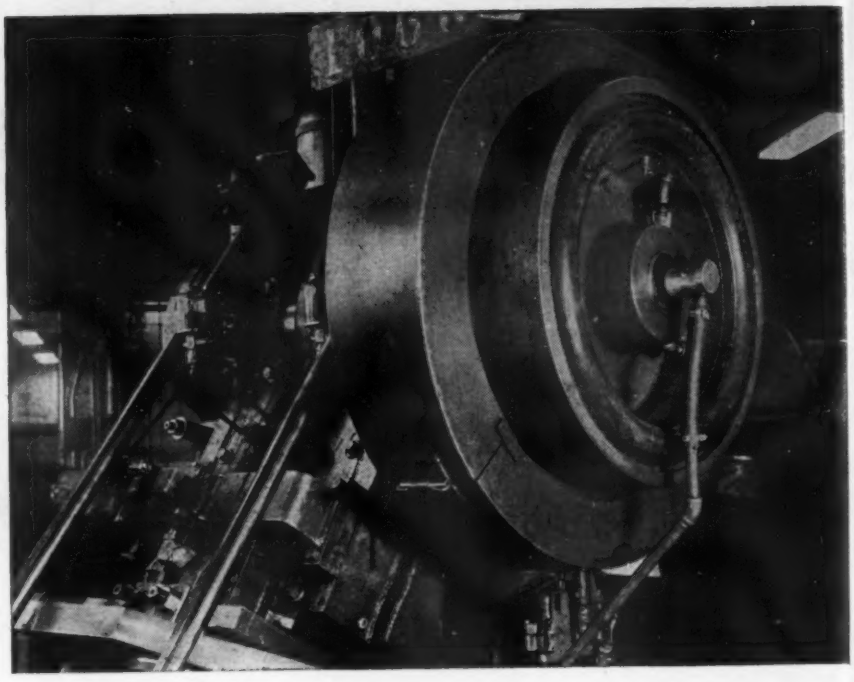

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. . . and one of our greatest war contributions—DURABONDED COATED ABRASIVES—will be an even greater boon to peacetime grinding and sanding after V-J Day.

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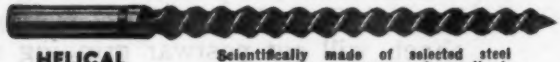

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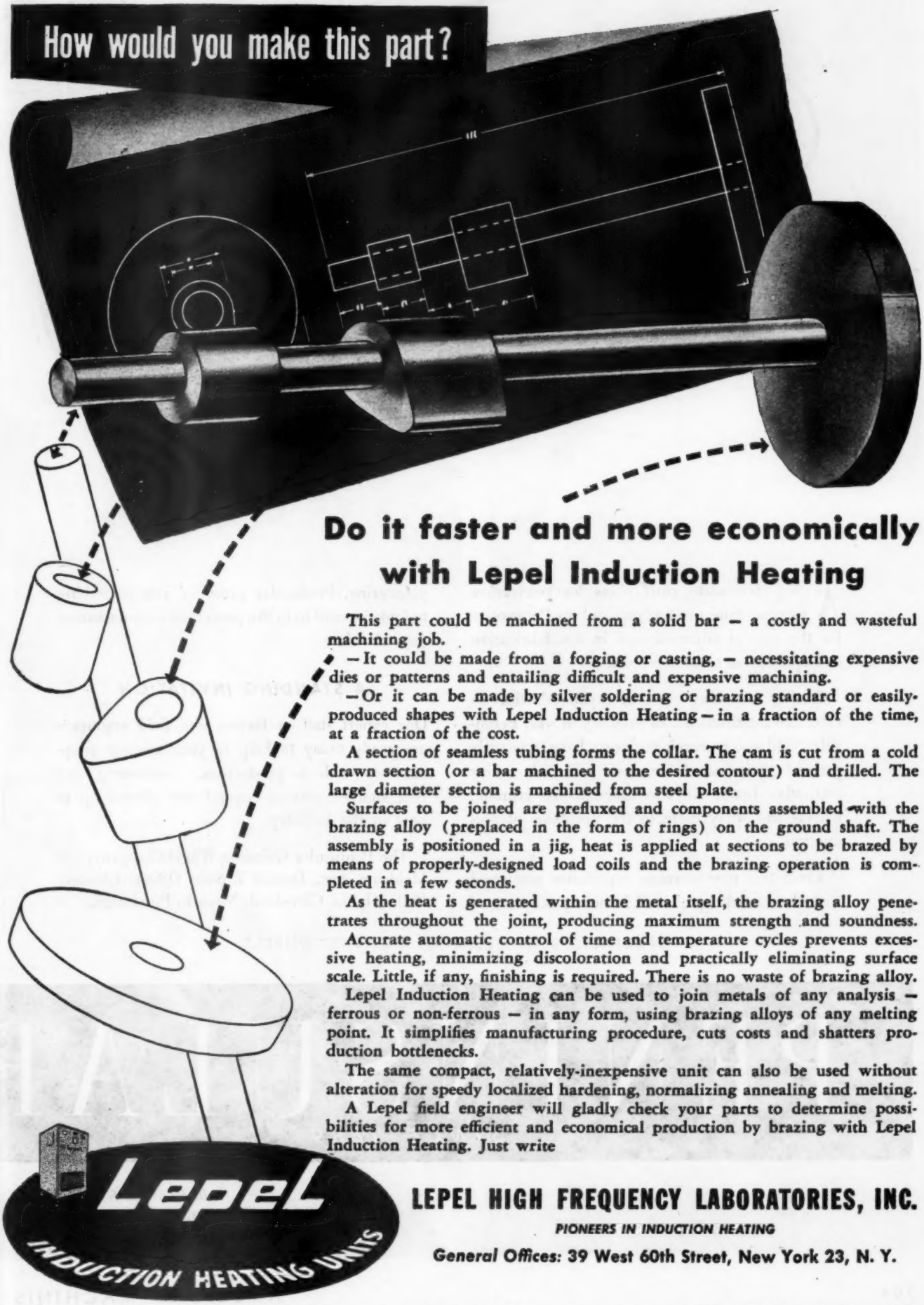

Do it faster and more economically with Lepel Induction Heating

This part could be machined from a solid bar — a costly and wasteful machining job.

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During four long years of expanded effort to meet the requirements of industry at war, Peninsular field and research engineers have constantly pressed their search for new materials — new methods — better ways to manufacture grinding wheels and apply them to the problems of production.

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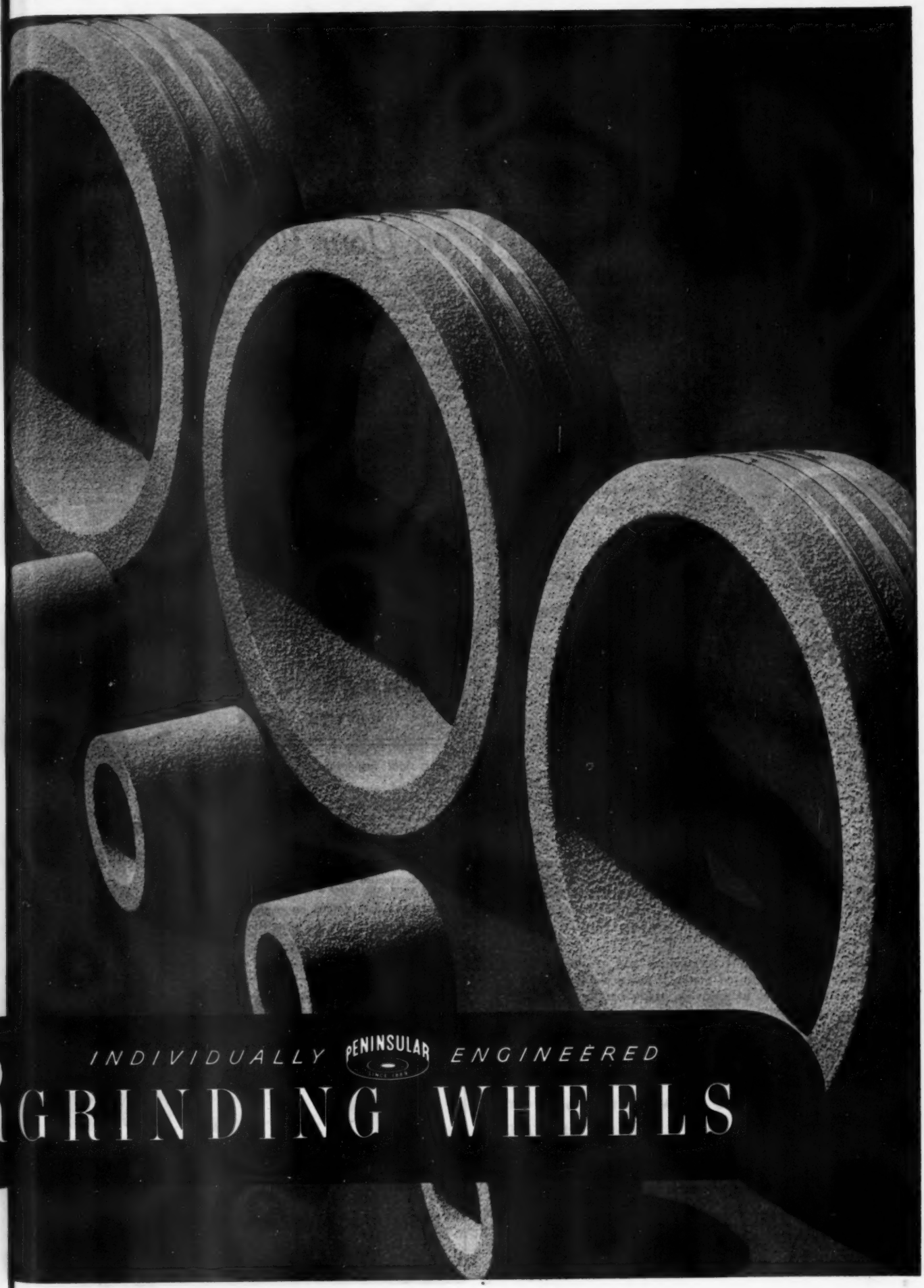
PENINSULAR

SINCE 1889

Cylinder wheels for various types of surface grinding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GRINDING WHEELS

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MAKE or HEAT TREAT
any kind of TOOLS or DIES

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- improve tool performance and cut costs
- save time and money in the toolroom
- the relation of design to heat treatment
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By FRANK R. PALMER
Vice-President of
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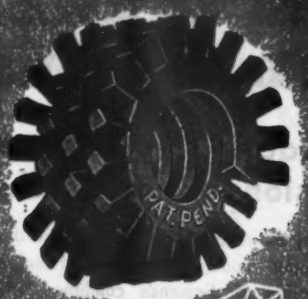
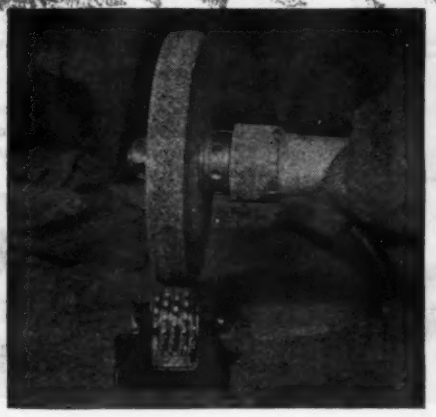
EMERY WHEEL DRESSERS

Perfect Conditioned Grinding Wheels at Much Lower Costs...



"LIKE A RARE JEWEL IN A CLASS ALL ITS OWN CANNOT BE OUTPERFORMED"



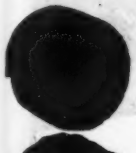
SPECIAL HOLDERS

Special applications for the SPI-RAL cutter are numerous. Pictured above is just one of the many special holders being built for special dressing operations. The above is a 54" disk wheel being dressed with one No. 410 SPI-RAL cutter. We welcome any inquiries regarding emery wheel dressing.

The D-310 SPI-RAL dresser being used to dress and recondition the emery wheel of an air operated hand grinder. The D-310 SPI-RAL dresser is fastened to the bench and the operator, with very little effort moves the running emery wheel over the SPI-RAL dresser and in a few seconds reconditions the grinding wheel.

The SPI-RAL dresser is never tilted when applied against the emery wheel, but is held as shown in the picture above. A sure grip, an even pressure, held straight against the wheel, "no tilting" and a slow movement from side to side will result in a true and well dressed emery wheel, free of foreign matter, grooves and ruts.

No. 10 SPI-RAL DRESSER



For tool grinders and wheels that require a very fine finish.
No. 10 Dresser Complete.....$2.50
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No. 21 SPI-RAL DRESSER

For medium or soft grain wheels where a smooth surface is desired.
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No. 31 SPI-RAL DRESSER

For fast dressing of coarse wheels. For foundry or any other snagging operations.
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No. 310 Cutter Only..... .85
Nos. 110, 210 and 310 cutters are interchangeable in the same handle.
Cutters are 1¾" diameter by 1 1/16" long.

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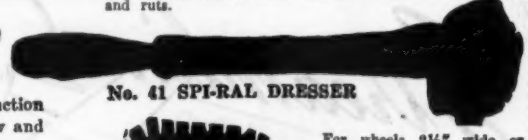
The principle of design and construction of the SPI-RAL cutter is basically new and is covered by patent rights. The cutter is made in a single piece spiral, in various sizes, which, when employed in the dressing operation of an emery wheel, cuts across the face of the wheel evenly, rather than bumping off the grain. The result is a truer dressed wheel with not only an economy effected in the life of the emery wheel, but in the longer life of the dressing cutter itself.

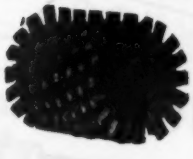
The cutter revolves on a bushing which in turn revolves on the shaft, giving it a double bearing and reducing friction to a minimum.

All moving parts are properly hardened and are provided with oiling facilities.

The hooded handle protects the operator from flying abrasives.



No. 41 SPI-RAL DRESSER



For wheels 2½" wide or wider. For foundry and coarse grinding operations. Rugged construction for heavy duty service.
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No. 410 Cutter Only..... 1.25

No. 42 SPI-RAL DRESSER

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Nos. 110, 210 and 310 cutters interchangeable in No. D holder. Unless specified, No. 310 cutter is furnished.
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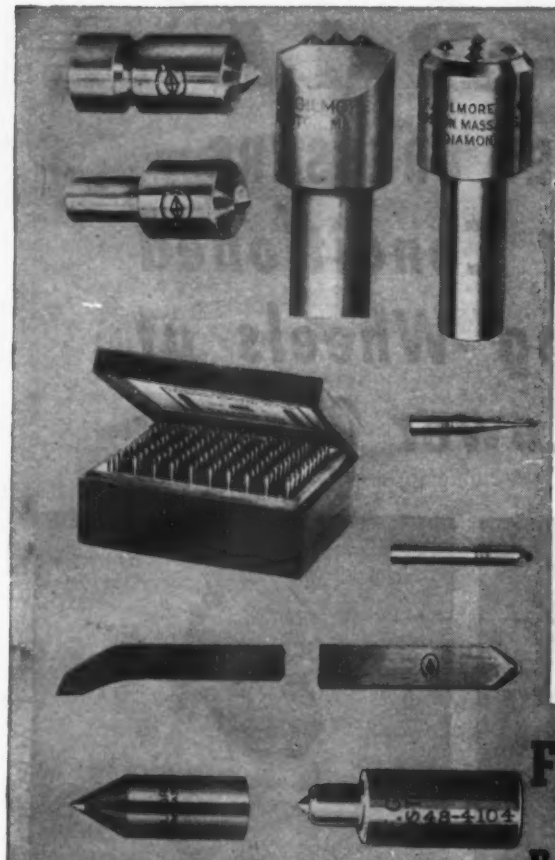

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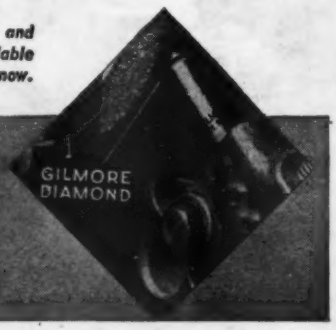

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Here is a commonsense handbook for all men who are looking for ways of increasing efficiency and speeding up production. It explains how to analyze an industrial operation, how to break it down into its component parts, and how to question each part systematically to bring out possible chances for improvement. It gives the major factors that must be considered in analyzing any job, and for each lists a number of specific, practical questions, all of which have proved successful in the past in bringing about methods improvements. Typical examples of improvements resulting from these questions are shown in the appendix.

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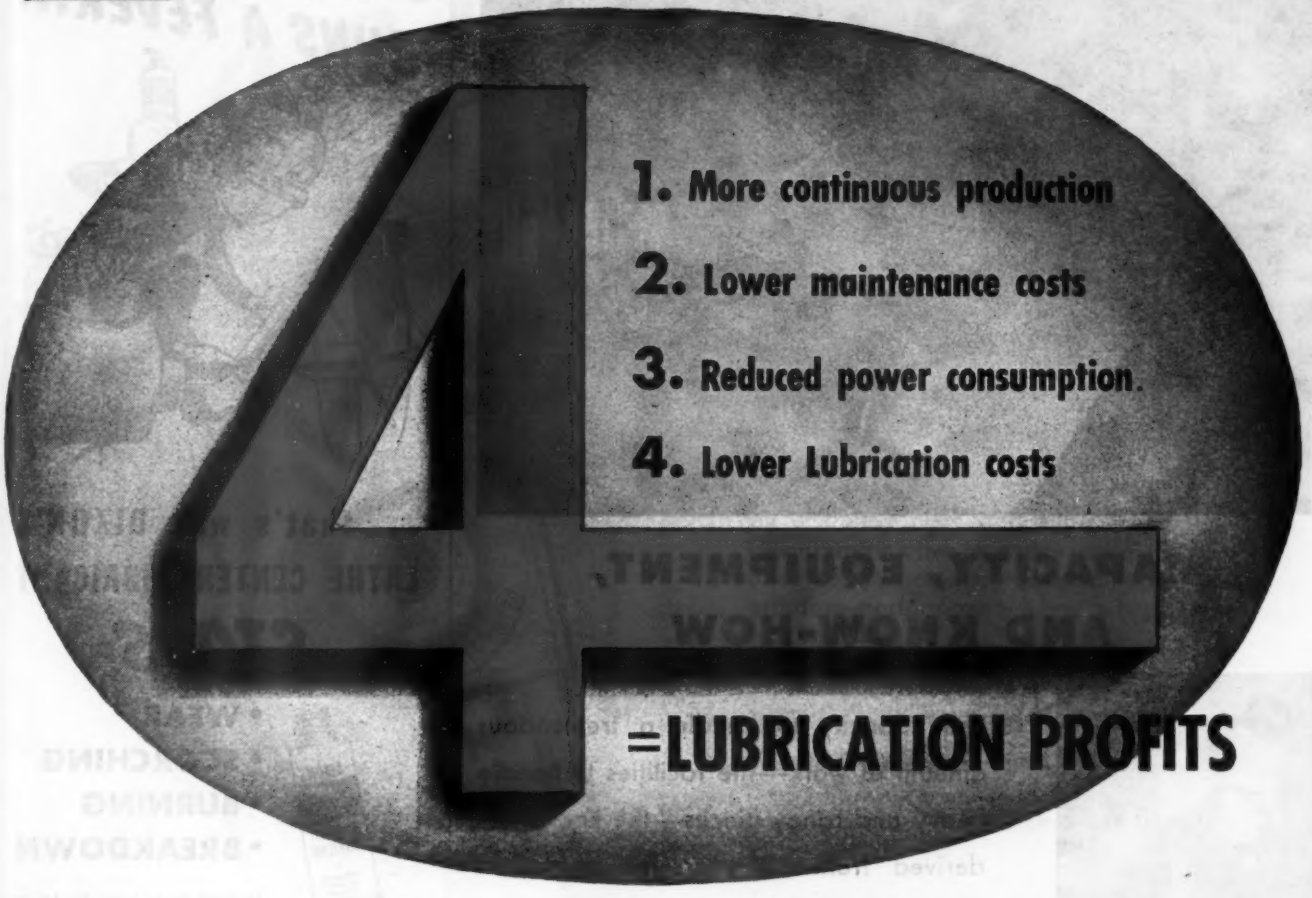

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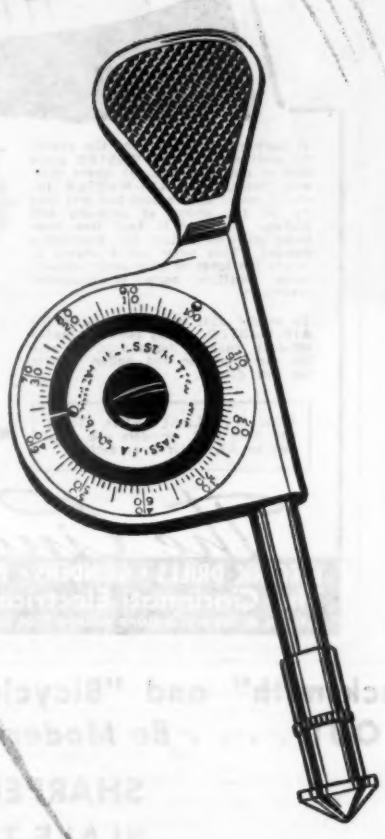
SPEED



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PLANER TOOLS *that* LAST LONGER

because holders are made of a chrome nickel drop forging, practically unbreakable in shop practice. A file hard support under the cutter *prevents breaking of tool bits.*

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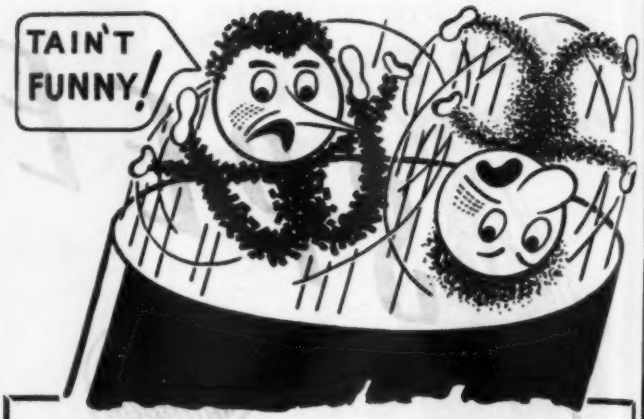
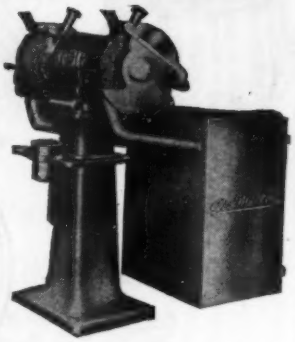


It isn't at all funny when the powerful suction of the AIR-MASTER grabs hold of dust and grit. It means their sure finish. The AIR-MASTER instantly sucks up the dust and grit that fly off the wheels of grinders and buffers. The air is kept free from those millions of tiny but destructive demons. They never get a chance to injure the lungs of your employees—to harm sensitive parts of expensive machinery.

To master dust and grit, install the AIR-MASTER. Fully self-contained—efficient, rugged, dependable. A size for every grinder and buffer. Write for full details.

NOW AVAILABLE—Two, Three and Five H.P. grinders and buffers on AAS priority or better.



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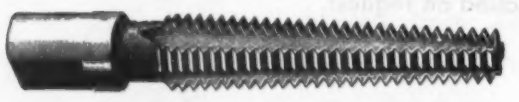

Model No. 1 for taps up to 6" long
Model No. 2 for taps up to 14" long

"Blacksmith" and "Bicycle" Tap Methods are OUT . . . . *Be Modern — Be Accurate*

SHARPEN TAPS ON A BLAKE TAP GRINDER

In the days of "Blacksmith" and "Bicycle" taps, a taper thread was used to assure a fit on the screw *somewhere* in the hole. With modern precision taps, standards of fit are measured in "tenths" to assure contact *everywhere* on the threads. Such tolerances must be held throughout the life of every tap—must be held during every sharpening. That's where the Blake Tap Grinder comes in. Here is a modern machine offering a modern method for keeping taps at original sharpness. Here is a machine that will sharpen the chamfer on left- or right-hand taps with 2, 3, 4, 5, 6, 8, or 10 flutes. And you have your choice of methods for holding the tap—on the shank—on the thread—on the centers.

No machine is better than the cutting edge of the tool it uses.

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BLAKE TAP GRINDERS — FILTAIRE PORTABLE DUST COLLECTORS — AMERICAN TOOL HOLDERS — BLACK DIAMOND PRECISION DRILL GRINDERS — WALTHAM CUTTER SHARPENERS

Please send me Bulletin No. 544 which describes the Blake Tap Grinder in detail.

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over 500% increase in TAP LIFE

by Sub-Zero Treating in a *Deepfreeze* Industrial Chilling Machine

Sub-zero Treating Increased Production from 2,000 to 12,000 Tapped Holes per Sharpening and Greatly Reduced Machine Down-Time

Here is an example of how Cold Treating increased the productivity and efficiency of *one type* of metal cutting tool. This large Midwestern manufacturer taps 6 holes in cast-iron automotive brake cylinder blocks with a $\frac{5}{16}$" tap.

Prior to Cold Treating, production averaged was 2,000 holes per tap sharpening. This required changing taps after the completion of approximately 300 blocks, resulting in excessive machine down-time. Some method had to be found to increase tap life and lessen it.

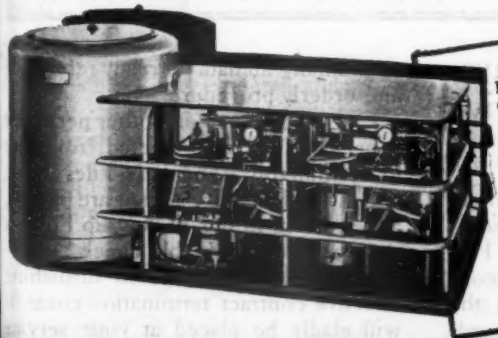
Cold Treating in a Deepfreeze Industrial Chilling Machine solved the problem. By subjecting these taps to sub-zero temperatures of −120° F., tap life was increased from 2,000 to 12,000 holes per tap sharpening—a total productive increase of over 500%. This increase greatly minimized machine down-time. Instead of changing taps every 300 blocks, now from 1,500 to 1,800 blocks are tapped before a change is required.

How Cold Treating Increases Performance Life of Tools

Rapid wear of the conventionally heat-treated taps indicated sub-zero treatment as a possible remedy. Sub-zero treatment at −120° F. gave a structure possessing an improved combination of hardness and toughness, resulting in increased cutting efficiency and lengthened tool life.

Cold Treating Has Numerous Applications

Cold Treating is not restricted to cutting tools. It is also applied with outstanding results to other types of tools and parts where increased hardness and uniformity of structure are demanded for maximum efficiency. It provides the only practical solution of stabilizing gauges and precision parts where a high degree of stabilization is required. It reduces costs and increases production on shrink-fit assembly. It is being widely used for testing materials and numerous miscellaneous applications.



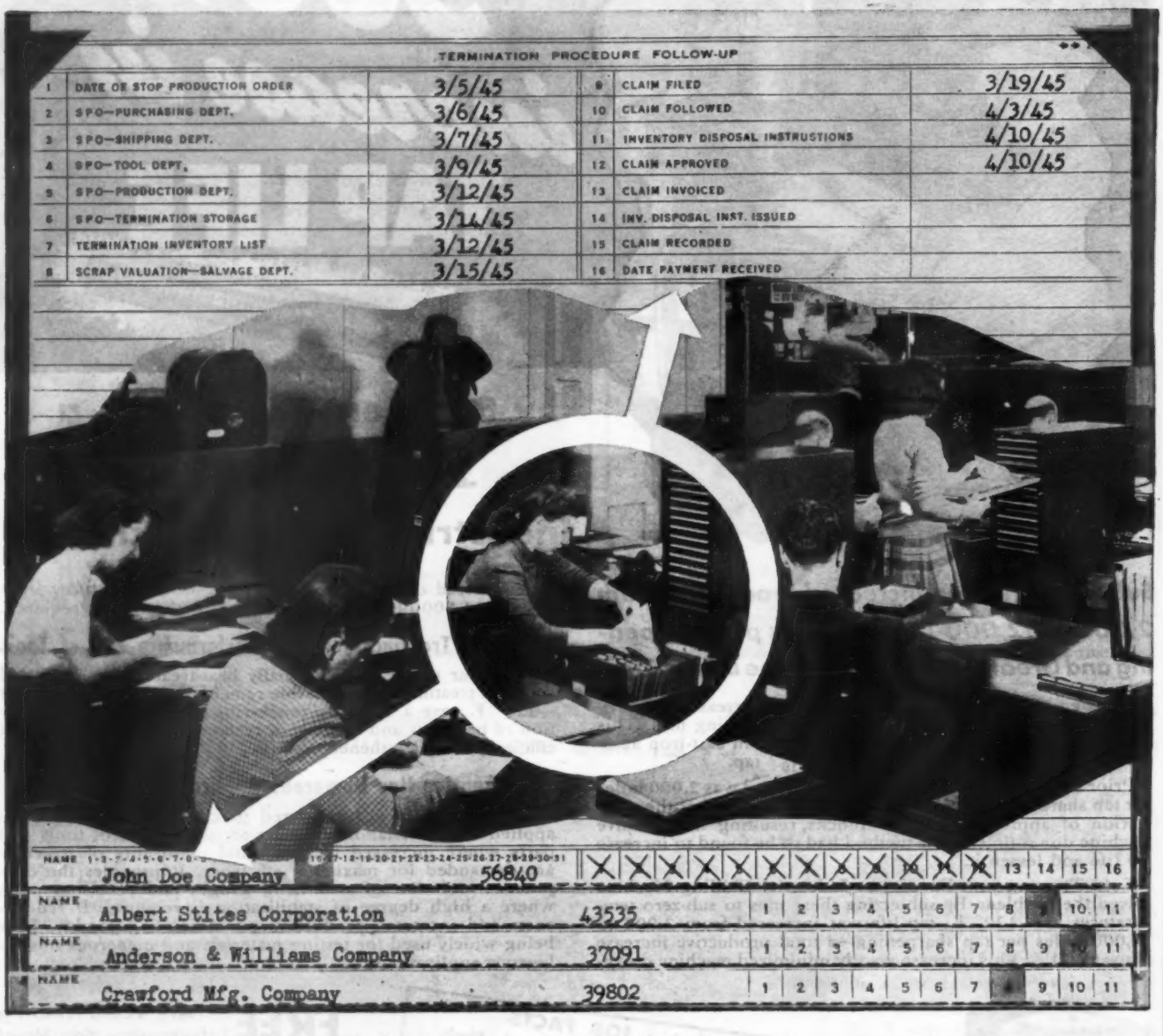
JOB FACTS

Part—Cast-iron Cylinder Brake Block.
Operation—Tap 6 holes.
Machine—Huskins Tapping Machine.
Tool—$\frac{5}{16}$" Wood and Spencer Tap.
Tap Life Before Cold Treating—2,000 holes per sharpening.
Cold Treating Medium—Deepfreeze −120° F. Industrial Chilling Machine.
Tap Life After Cold Treating—12,000 to 15,000 per sharpening.
Remarks—From 10,000 to 13,000 more holes tapped per sharpening; machine down-time greatly reduced.

FREE...*Here's Cold Treating Information You Need*

To completely understand the underlying principles of cold treating and to determine how and to what extent it can be applied to your production, write for this valuable 40-page bulletin. It gives you concise, factual data on Cold Treating from its inception to the present time. Complete with tested procedures, field test reports and specifications of Deepfreeze Industrial Chilling Machines—this book merits a place in your technical data file. Write today for your free copy of Bulletin I-4.

CONTROL makes short work of **TERMINATIONS**


TERMINATION PROCEDURE FOLLOW-UP
1 DATE OF STOP PRODUCTION ORDER 3/5/45
2 SPO—PURCHASING DEPT. 3/6/45
3 SPO—SHIPPING DEPT. 3/7/45
4 SPO—TOOL DEPT. 3/9/45
5 SPO—PRODUCTION DEPT. 3/12/45
6 SPO—TERMINATION STORAGE 3/14/45
7 TERMINATION INVENTORY LIST 3/12/45
8 SCRAP VALUATION—SALVAGE DEPT. 3/15/45
9 CLAIM FILED 3/19/45
10 CLAIM FOLLOWED 4/3/45
11 INVENTORY DISPOSAL INSTRUSTIONS 4/10/45
12 CLAIM APPROVED 4/10/45
13 CLAIM INVOICED
14 INV. DISPOSAL INST. ISSUED
15 CLAIM RECORDED
16 DATE PAYMENT RECEIVED
NAME John Doe Company 56840
NAME Albert Stites Corporation 43535
NAME Anderson & Williams Company 37091
NAME Crawford Mfg. Company 39802

P. R. MALLORY & CO., INC. knows how to avoid delays, speed settlements... Key to their operation is effective use of **KARDEX VISIBLE** Record Control

● Precision electrical and electronic parts produced by P. R. Mallory & Co., Inc. of Indianapolis will play an enormous role in peace, as they do in war.

But a first essential to peace-time operation is the settlement of terminated war contracts. To eliminate lost time, protect assets and obtain early payments, P. R. Mallory employs a very fine Kardex contract termination record and procedure follow-up control.

The follow-up record provides a history of the sixteen steps incident to each termination. On the visible margin the exact status of any settlement is revealed at a glance, each stop being checked off as it is accomplished. Follow-up on the next operation is controlled by the colored signal on the 1-to-31 day scale. Termination records for vendors follow each contract card, centralizing all data for ready reference and orderly procedure.

Correspondence and other pertinent papers are wisely protected from fire in Remington Rand Safe-Files upon which the Kardex Cabinets are placed, and are filed in our Follow-up Folders that operate as a double check.

Our wide experience in furnishing effective contract termination controls will gladly be placed at your service through our nearest Branch Office.

SYSTEMS DIVISION

REMINGTON RAND

Buffalo 5, New York

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Announcing

AN IMPROVED LINE OF TIMERS FOR RESISTANCE-WELDING MACHINES

now **G-E Sequence and Sequence-weld Timers Offer You**

1. **Greater flexibility**
2. **Easier installation and servicing**
3. **More accurate timing**

A credit to your plant, this sequence-weld timer has been designed to meet the New American War Standards of Controls for Resistance Welding Machines (C52.4).

IF YOU are using Air-operated welders, you will be interested in this completely redesigned line of sequence and sequence-weld timers which provide consistent and automatic timing of the complete welding cycle. It includes controls for all standard combinations in which ignitron contactors or synchronous-precision timers are used.

You can change welding sequence easily—Each control is constructed in such a way that the timing control section can be removed in less than a minute—and placed in another machine. This feature is particularly desirable for assembly-line welding because a single spare unit can be used to replace any one of a number of similar timing control sections. And, consequently, servicing will not hold up production.

Also, when production-line requirements change, timing control sections of different types can be interchanged quickly without rewiring.

Because the timing control section can be removed easily (making readily accessible the terminal boards and mounting holes), installation of the complete timer is greatly simplified.

A new and more accurate timing circuit provides consistent welding speed as required for high production welding with short timing intervals, despite nominal variations in line voltage.

Long tube life—The new G-E metal thyratron tube, installed in the timing circuit, will keep this control operating precisely for a long time.

Remote operation—For the convenience of the operator in making adjustments, the timing-control station can be removed easily and mounted on the welding machine or elsewhere.

Built for Your Serviceman

These redesigned controls have many additional features which simplify routine inspection and servicing. Standard industrial-type relays, with which your electrician is familiar and which are easy to service, have been used throughout. Also, by redesigning the wiring system and mounting most of the small resistors and capacitors on a terminal board, servicing has been greatly facilitated.

Need More Information?

Your local G-E office will be glad to tell you more about the jobs that these controls can do—and are doing. Or write directly to us for more information. *General Electric Co., Schenectady 5, N. Y.*

GENERAL ELECTRIC

RESISTANCE-WELDING CONTROL

Buy all the Bonds you can—and *keep all you buy*

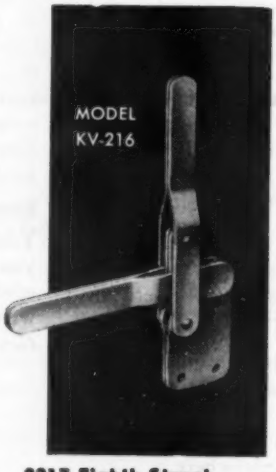
APPLICATION OF MODEL KV-196

Do You Want VERSATILE CLAMPS?

Here are two—typical of the score of clamps designed by Knu-Vise for increasing efficiency where holding is required.

The toggle bar of Model KV-196 (above) permits pressure spindle to be located anywhere along its length. When spindle is positioned at extreme end, pressure of 180 lbs. is obtained with only 30 lbs. pressure on handle.

The toggle bar of Model KV-216 (lower view), being solid, can be cut to suit your special needs. With a pressure of 70 lbs. on the handle a maximum pressure of 240 lbs. can be obtained ⅜" from end of toggle bar.



Send for illustrated catalog giving information on all types of toggle-action clamps available for your use.

BUY WAR BONDS

KNU-VISE INCORPORATED

2217 Eighth Street
Detroit 16, Michigan
4328 San Fernando Rd., Glendale, Calif.

30 TO 60% MORE PARTS

This Barker Chuck increased output 60%

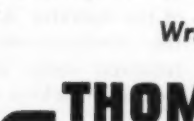
Output went up 30% with this Barker Chuck

WHEN USING BARKER WRENCHLESS CHUCKS

Barker Two-Jaw Chuck

Barker Three-Jaw Chuck

Barker Two-Jaw Vise



Barker Three-Jaw Vise

Consider the cases of two manufacturers in the central west. One, making bronze plugs, increased production from 75 to 120 parts per hour when he installed a Barker Wrenchless Chuck. The other put a Barker Chuck on an automatic lathe and output jumped up from 18 to 24 pieces per hour. Such results are typical—so typical that many companies enter repeat orders, and numerous shops are using from three to as many as forty Barker Chucks to increase production and cut costs. Saving made by these chucks pay the first cost in an astonishingly short time.

Send piece part prints and outlines of your operations—our engineers will promptly make cost saving recommendations.

Write for Bulletin No. 201

THOMAS HOIST CO.
Chuck Division
20 South Hoyne Avenue, Chicago 12, Illinois

The FUNDAMENTALS of.. The *Ettco-Emrick System* of MULTIPLE DRILLING AND TAPPING HEADS

The Ettco-Emrick System provides both the method and the equipment for obtaining *maximum production* in the drilling and tapping of small parts at *minimum tooling cost*. Two features account for the low tooling cost — (1) The equipment can be used on any drill press — (2) It is made from standardized stock parts.

The System is founded on the four basic elements illustrated, which are as follows:

1—A standard ball-bearing drilling face plate unit which is clamped to the drill press quill.

2—A standard centrally driven tapping face plate unit which is also clamped to the machine quill.

3—A standard gear case, jig bored and equipped with standard gears, bushings and spindles arranged to meet the multiple drilling or tapping requirements of the specific job. The gear case can be interchangeably bolted to either face plate. Hence, on short run jobs, the same gear case can be used for both drilling and tapping. Simply change the face plate unit and the chucks.

4—A standard bed plate with guide rods which fit into bushings attached to the gear case. On this bed plate is mounted a work holder, jig or fixture specially designed for the requirements of the specific job.

Note that these elements assemble and tie up as a unit like a punch and die. Set-up and take-down of this unit on your drill press is a matter of a few bolts.

The number of spindles depends on the material, number and size of holes and their depth and is determined by Ettco engineers from a study of the particular job. Most of the parts can be reused in converting heads for other jobs.

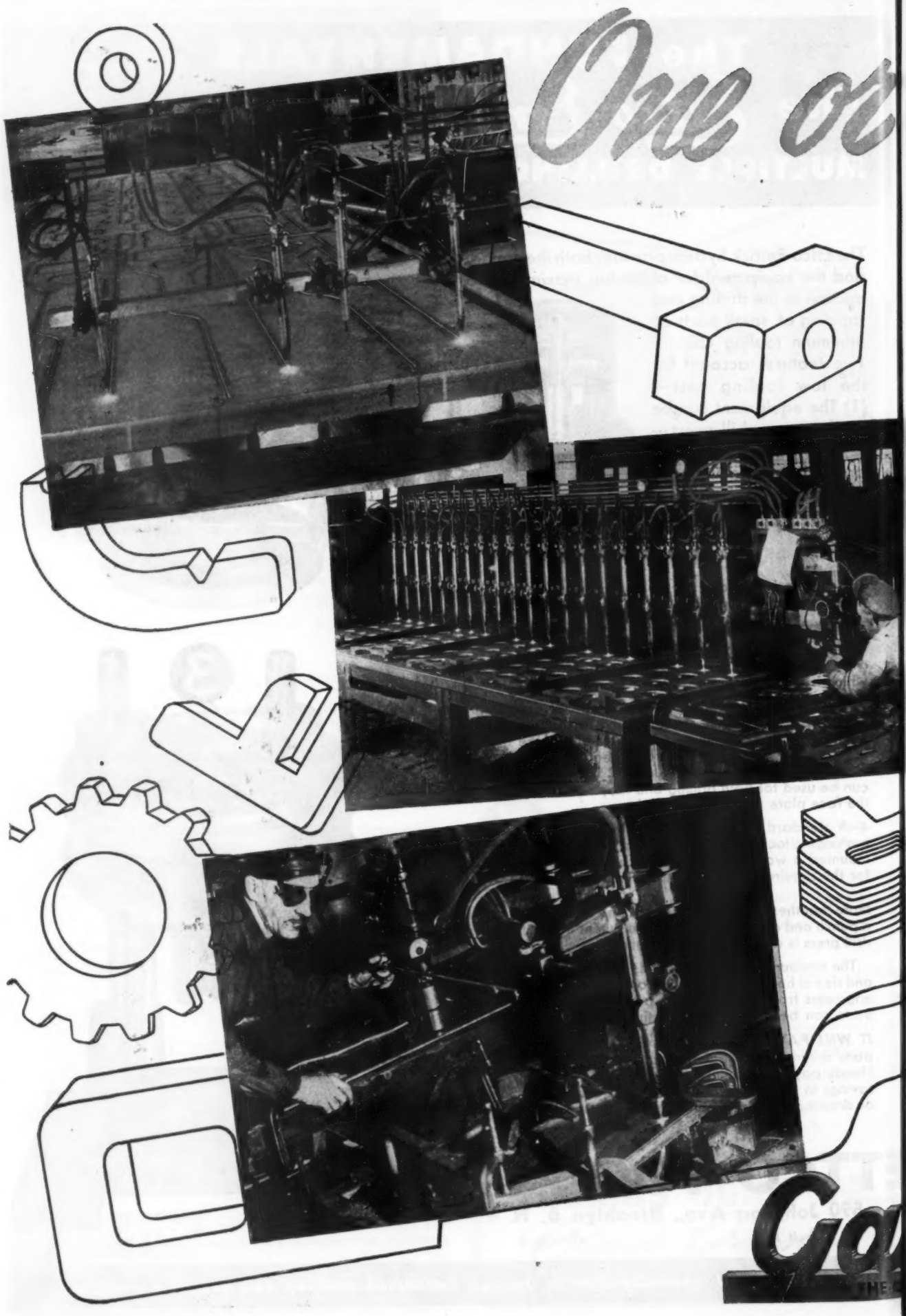
IT WILL PAY YOU WELL **to consult Ettco on your small parts drilling and tapping, because Ettco-Emrick Multiple Heads pay their nominal cost over and over again by savings in man-hours and machine-hours. Send a sample or drawing for recommendations and estimates.**

ETTCO TOOL CO.

590 Johnson Ave., Brooklyn 6, N. Y.

Detroit 1 *Chicago 6*

Over 25 years specialization in solving industrial drilling and tapping problems


One of

One Million

You Can Flame Cut Accurate Steel Parts of Any Contour, and of Practically Any Size, Faster and More Economically with the Proper Airco Gas Cutting Machine

As pioneer designers of flame cutting machines, Airco has been and continues to be in the forefront in the development and application of these machines.

To enable manufacturers to take advantage of the opportunities for economy and product improvement which flame cutting offers, Airco has perfected three pantograph type cutting machines which, by reason of their range and flexibility, meet practically every requirement for parts production by this process.

The Planograph is mounted on a carriage which travels on the tracing table. Maximum cutting range with single torch is 24" wide by 72" long, and maximum diameter for circle cutting is 24".

The Oxygraph is one of the most popular shape cutting machines ever offered. It is designed for single or multiple torch operation.

The Travograph is a machine having the basic design of the Oxygraph, but mounted on a carriage which travels on steel rails. Maximum cutting widths are 6', 10' and 12', depending upon the model of machine used. The cutting length is limited only by the length of rails installed. These machines also are designed for single or multiple torch operation.

To afford greatest flexibility, three types of tracing devices are available — all quickly interchangeable on each type of machine.

The Manual Tracing Device is hand guided by the operator, following a full size drawing or layout of the part. It can also be locked to travel in straight lines in any direction, saving time when cutting irregular shapes involving considerable straight-line cutting. The manual tracing device is designed primarily for use where a small number of parts is to be cut.

The Magnetic Tracing Device makes the operation of the machine practically fully automatic. The magnetic force holds the rotating roller against a steel cam or template of the design to be cut, assuring positive traction and close adherence to the contour of the template. It is especially recommended for use in producing parts in large numbers and its use frees the operator for other work during a good part of the cutting operation.

The Spindle Tracing Device has a power-driven spindle which the operator holds against a template of plywood or similar material shaped to the design to be reproduced. This contact affords the necessary traction to move the tracer around the contour of the template. It is designed for use where the number of parts to be cut justifies the cost of making the template.

• Folders describing these gas cutting machines in fuller detail may be obtained from the nearest Airco office or from Dept. AM, Air Reduction, General Offices: 60 East 42nd Street, New York 17, N. Y. In Texas, Magnolia Airco Gas Products Co., General Offices: Houston 1, Texas.

AIRCO

AIR REDUCTION

OFFICES IN ALL PRINCIPAL CITIES

Cutting Machines

CARD PIPE TAPS ... *maintain quality under quantity demands*

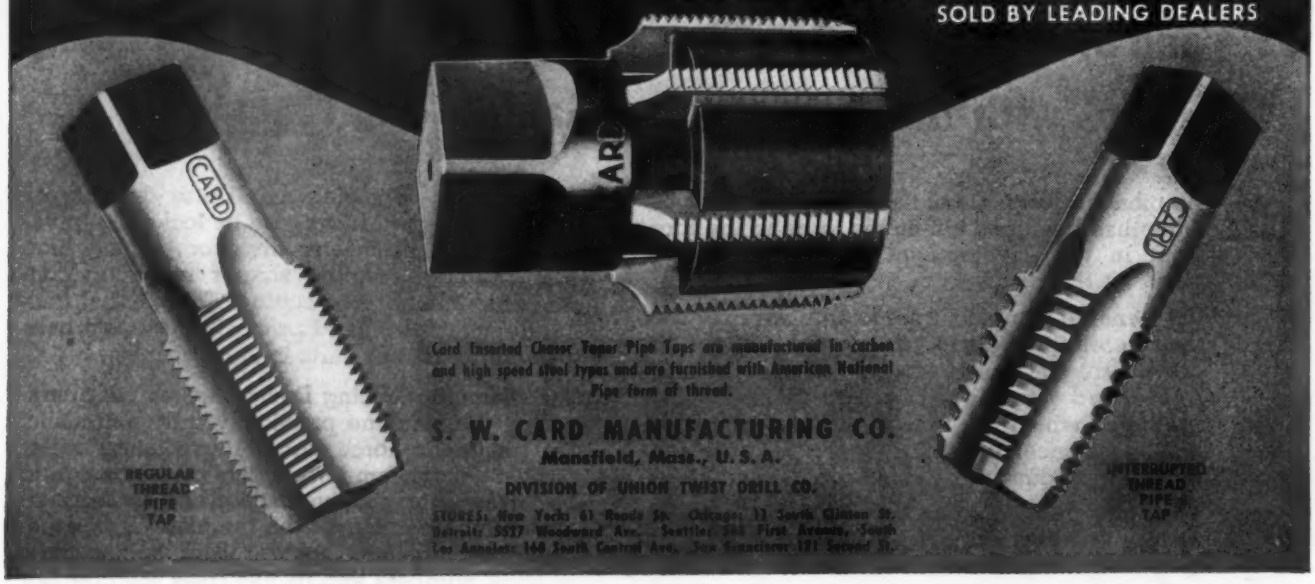
Card Regular Type High Speed Steel Cut Thread Pipe Taps are ideal tools for high production tapping in cast iron, malleable iron and other materials where chips break up, allowing the tap to properly clear itself.

Card Regular Type High Speed Steel Ground Thread Pipe Taps are recommended for high production tapping in cast iron, malleable iron and other materials where chips break up, allowing the tap to properly clear itself. Used where close accuracy and a high quality of production work is required.

Card Interrupted Thread High Speed Steel Taper Pipe Taps are designed for tapping in soft steel and forgings. They are recommended for use where a particularly fine quality of thread is demanded. These taps have less cutting teeth per thread section, can be operated with less friction and are superior to full thread taps for this class of tapping.

Send for the Card Catalog giving complete details.

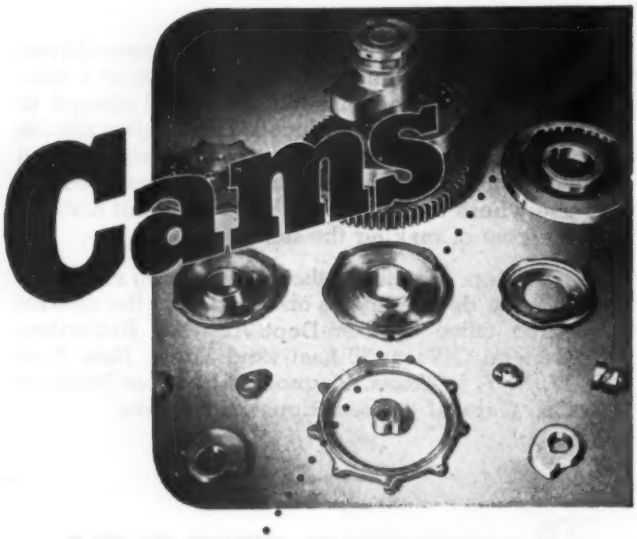
SOLD BY LEADING DEALERS



Card Inserted Chaser Taper Pipe Taps are manufactured in carbon and high speed steel types and are furnished with American National Pipe form of thread.

S. W. CARD MANUFACTURING CO.
Mansfield, Mass., U. S. A.
DIVISION OF UNION TWIST DRILL CO.

STORES: New York 61 Reade St. Chicago: 11 South Clinton St. Detroit: 5527 Woodward Ave. Seattle: 566 First Avenue, South Los Angeles: 160 South Central Ave. San Francisco: 121 Second St.



● **25 YEARS** of experience in making special cams for thousands of companies has made us experts at cam cutting and grinding. Our facilities and equipment, the most complete of any plant in the country, permits us to manufacture any style or size of Cam, Geneva Motion, or Scroll Plate in quantities of 1, 10 or 10,000. Accuracy can be held to split thousandths, and surfaces to micro-finishes. Send us specifications or blueprints and we will be glad to submit a detailed quotation to you on your requirements.

KUX MACHINE COMPANY
3924-44 WEST HARRISON STREET • CHICAGO 24, ILLINOIS

Precision — WITH DURABILITY

Thread Plugs
Thread Rings
Plain Plugs
Plain Rings
Snap
Flush Pin
Profile
Build-up
Thread
Concentricity
Jigs, Dies and Fixtures

● Like Big Ben, the famous London clock with its long-enduring reliability, Master Gauges are also known for their exceptional durability and precision. They should be your choice for use in both war and peacetime production.

MASTER GAUGE CO.
2214 Fenkell Ave. Detroit 21, Mich.
Phone: University 3-7676

How a 40-dollar ELGIN Sapphire Gage saved Stewart-Warner $4,000 PLUS!

Still showing less than .00001 inch wear, well within tolerance limits, an Elgin Sapphire Plug Gage has delivered the incredible total of 158,220 close tolerances gagings! Hi-speed *steel* gages, formerly used, wore beyond tolerance use after only 300 gagings! The startling contrast in *gage* cost only for 158,220 gagings is shown in the table below:

ESTIMATE OF COMPARATIVE COSTS

GAGE	GAGES REQUIRED	COST	TOTAL COST
STEEL	527	$ 8.00 ea.	$4,216.00
ELGIN	1	40.00 ea.	40.00
		SAVINGS—$4,176.00	

This tremendous saving is on one only of many gages on this job at Stewart-Warner—many Elgin Sapphire Gages are in constant use at the plant.

The phenomenal wear resistance of the Elgin Gage offers for the first time an approach to the absolute in dimensional fidelity—this saves in eliminating the now-too-frequent worn gage rejects. Chemically inert at normal temperatures, its gaging elements of sapphire do not rust, corrode or become distorted with use.

Write for prices and information on Elgin Sapphire Plug and Ring Gages.

★ ★ ★

ELGIN SAPPHIRE PRODUCTS PRESENT MANY ADVANTAGES FOR ALL THESE TYPES OF EQUIPMENT:

GAGES · THREAD GUIDES · EXTRUSION DIES · KNIFE EDGES · SPRAY NOZZLES · SOFT WIRE DIES · BURNISHING TOOLS · PRESSURE VESSEL WINDOWS · WATCH CRYSTALS · HONING STONES

AMERICA'S BEST EQUIPPED SAPPHIRE FABRICATOR

ELGIN NATIONAL WATCH COMPANY

SAPPHIRE PRODUCTS DIVISION

932 BENTON STREET, AURORA, ILLINOIS, U.S.A.

Vitrified

BORITE—for all kinds and classes of steel grinding.

CARBORITE—for all classes of cast iron, brass, bronze and aluminum grinding.

Also, Silicate, Shellac and Resinoid Bonded Wheels.

Cuts longer between turns

Vitrified Grinding Wheels assure economy in high quantity production fine precision grinding because they cut longer between each wheel truing. Then, too, these long life, strong wheels require less redressing. They can also be depended on to eliminate gumming, glazing and heating.

All these advantages are available regardless of the grinding job, because there is a size, shape and type Vitrified Grinding Wheel for every grinding purpose. The completeness of the Vitrified line makes it possible for any shop to standardize on Vitrified Wheels.

Our engineers will gladly study your grinding operations and point out the savings you can make through the use of Vitrified Wheels.

VITRIFIED

VITRIFIED WHEEL COMPANY
WESTFIELD MASS.

BUZZER Gas BURNERS

For Many Industrial Gas Uses

NO BLOWER or POWER NECESSARY
. . . just connect to gas supply

Pipe Burners

Nozzle Burners

Ring Burners

Designed to solve numerous Industrial Gas applications, "BUZZER" Burners are unexcelled for Efficiency, Economy, Simplicity and Flexibility. Large variety of models available.

Send for the "BUZZER" Catalog showing complete line of Industrial Gas Burners, Furnaces and other equipment.

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121 So. Grand Ave. Baldwin, L. I., N. Y.

LUERS

Patented Cutting Off Tool Holders
Patented Cutting Off Blades

ONLY the PATENTED construction of LUERS cutting off BLADES permits normal expansion of bursting chips — MEANS MAXIMUM CUTTING EFFICIENCY.

Manufactured By
J. Milton Luers — 12 Pine St. — Mt. Clemens, Mich.
Produced under License Issued by John Milton Luers Patents Inc.

"WORLD'S FINEST CARBIDE"

Tantalum-Tungsten
***CARBIDE* Tools, Blanks and Dies.**
***TANTUNG* Cast Alloy Cutting Tools.**

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NORTH CHICAGO · ILLINOIS

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Consistent Quality

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at Kenmore Sq. BOSTON
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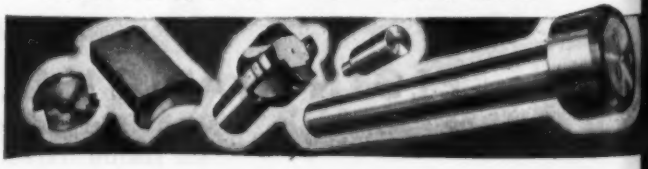
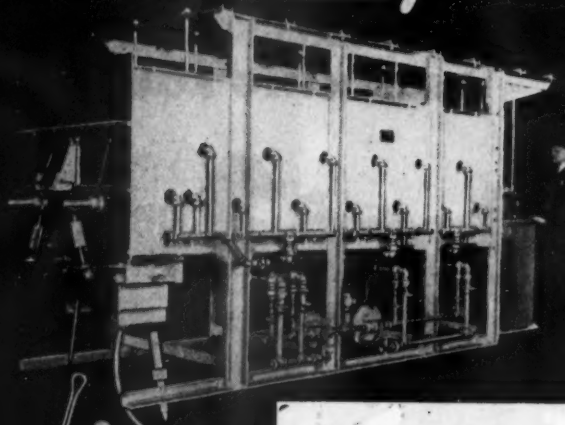
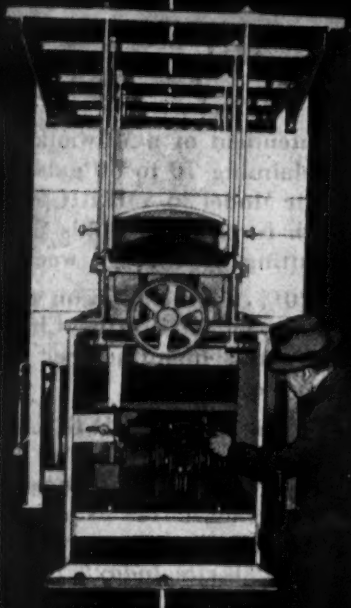


Work only enters and leaves--

the heating chamber of this latest and largest reciprocating hearth Heating Machine.



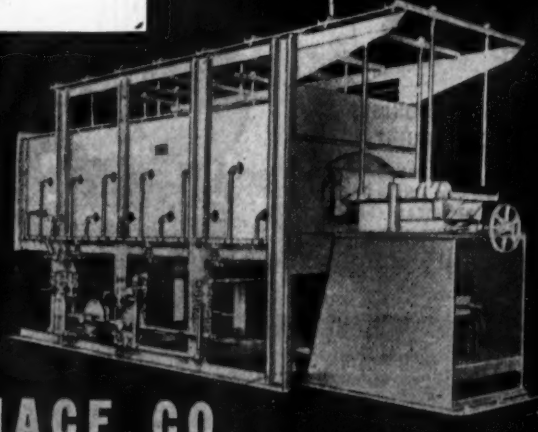


Suited to a wide variety of work, AGF Reciprocating Heating Machines may be used for continuous clean hardening, annealing, normalizing, Ni-Carbing, etc.

Work introduced into the reciprocating muffle is conveyed through the heat by its own momentum. The complete elimination of conveying mechanism from the heating chamber reduces maintenance problems and heat losses to a minimum. There is no traveling belt to be alternately heated and cooled—only work enters and leaves the machine.

Among users are manufacturers of bearings, bolts, screws, lock washers, tools, wrenches, flat and coil springs, chucks, steel writing pens, etc. The machines are supplied in five different sizes with capacities ranging from 10 to 1200 pounds per hour.

Write for literature



AMERICAN GAS FURNACE CO.

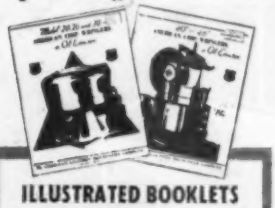
ELIZABETH, N. J.

$33 to $39 SAVED A WEEK

The superintendent of a Milwaukee plant reports they are reclaiming 70 to 80 gals. of cutting oil a day with their Model 26 AMERICAN Chip Wringer. At 55c a gal. for the oil, that's $38.50 to $44.00 worth of cutting oil saved a week.

Deducting 20% depreciation on an investment of approximately $1200 for the Chip Wringer and electric hoist, this manufacturer saves *$33.89 to $39.39 each week.*

In less than 3 minutes,* an AMERICAN Chip Wringer reclaims 90% of the cutting oil from a load of metal chips or machine turnings. Any unskilled person can operate it. Let us show you how much *your* plant will save per week with an AMERICAN Chip Wringer. *Write today! No obligation.



ILLUSTRATED BOOKLETS FREE ON REQUEST

Send for these booklets describing five different Models of AMERICAN Chip Wringer.

Lowering load of metal chips into Model 26 AMERICAN Chip Wringer.

ARMY E NAVY

The
AMERICAN LAUNDRY MACHINERY COMPANY
CINCINNATI 12, OHIO

Morton's SALT TABLETS

. . NOW AS FAMILIAR AND NECESSARY AS THE DRINKING FOUNTAINS

Only a few years ago, the drinking fountain stood alone. Today, in practically all leading industrial plants, it has a partner, the salt tablet dispenser. For, wherever men work — and sweat — water and salt go together.

Salt is a balance wheel in the human body. When salt is lost the body becomes dehydrated and the blood thickens. The result is Heat-Fag, lassitude, inalertness. Production suffers and accidents increase.

The easy, simple, sanitary way to replace the salt lost through sweat is with Morton's Salt Tablets. It costs less than a cent a man a week to have them available at every drinking fountain.

In salt tablets, as with other grades and types of salt, Morton is the recognized leader. Order Morton's Salt Tablets and Dispensers from your distributor or directly from this advertisement. Write for free folder. Morton Salt Co., 310 S. Michigan Ave., Chicago 4.

MORTON'S SALT TABLETS

Morton's Salt Tablets are available either plain or with dextrose.

Case of 9,000, 10-grain salt tablets - - - - $2.60

Salt Dextrose Tablets, case of 9,000 - - - $3.15

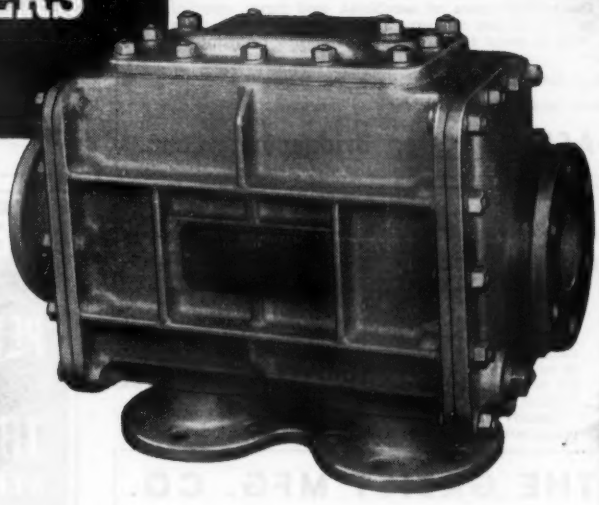
MORTON'S DISPENSERS

They deliver salt tablets, one at a time, quickly, cleanly — no waste. Sanitary, easily filled, durable.

800 Tablet size - - $3.25

MORTON'S SALT TABLETS

HARRISON
OIL COOLERS



Increase Production—
Decrease Cost

Harrison oil coolers, designed in types and sizes for practically every industrial application, maintain lube oil temperatures within the range required for proper lubrication.

Less wear on bearings and other critical parts —less time out for costly overhauls—increased efficiency . . . all are results of maintaining lube oil temperature within safe limits.

Compact and dependable, Harrison oil coolers are safeguarding production on varied types of machine tools and industrial installations.

Harrison engineers will be glad to make recommendations regarding your specific requirements.

Keep on Helping—BUY WAR BONDS

HARRISON

HARRISON RADIATOR DIVISION OF GENERAL MOTORS, LOCKPORT, NEW YORK

CONTRACT WORK

SPECIAL ENGINEERING WORK

ON A CONTRACT BASIS . . .
exactly to your specifications . . .

A complete and efficient service for the manufacture of machines and parts, special tools and fixtures, etc., is available to you in our modern, fully-equipped shop. We also offer cam milling facilities that will fit your requirements. You are guaranteed quality work at a reasonable cost.

Send your blueprints or samples today for prompt quotations at no obligation.

Designers and builders of wire and ribbon stock forming machines.

THE A. H. NILSON MACHINE CO., Bridgeport, Conn.

SCREW MACHINE PRODUCTS

STEEL—BRASS—ALUMINUM

MACHINE SHOP FACILITIES

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National Tool & Machine Co.
426-428 W. 55th St., N. Y. 19, N. Y.

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Fast Service on Long or Short Runs

"GREATER SAVINGS WITH GREIST"

We can handle your stamping and assembly requirements in any metal. Our modern equipment and methods coupled with 50 years of experience is your guarantee of accuracy and efficiency. Our facilities include capacity for handling screw machine products, tools, dies, jigs and fixtures.

Quality work by skilled mechanics is assured. Send your blueprints or samples today for prompt quotations!

THE GREIST MFG. CO.
546 BLAKE ST. NEW HAVEN, CONN.

METAL STAMPINGS

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PERMANENT MAGNETS

HEAT TREATING

THOMAS & SKINNER
STEEL PRODUCTS CO.
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AVAILABLE SCREW CAPACITY

¼ to 4½ Automatic and Hand Screws

Including Necessary Secondary Operation
Forward Samples and Blueprints for Quotations

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BUILDERS OF SPECIAL MACHINERY TOOLS & DIES

THE SPECIALTY MACHINE TOOL & DIE CO.
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PLANT EMPLOYING 200 PEOPLE HAS PRODUCTION TIME OPEN

- CENTERLESS
- TURRET
- MILLERS
- SHAPERS
- GRINDERS
- LATHES
- SUPPORTING EQUIPMENT

Over 200 Machine Tools

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• TOOL DESIGNING AND BUILDING • MACHINES DESIGNED • IDEAS DEVELOPED • PROMPT—EFFICIENT—SERVICE • • REASONABLE CHARGES •

OLD COLONY ENGINEERING CO.
180 Weeden St. • Pawtucket, R. I.
P.O. Box 672 • Tel. Blackstone 2610
Write — Phone or Telegraph

Long runs for Turret Lathe & Milling Machines.

VAHL ENGINEERING CO.
505 Court St. Brooklyn, N. Y.

PATTERNS in WOOD and METAL

For All Kinds of Castings, Large or Small
MATCH PLATE WORK A SPECIALTY
Put your pattern problems up to us—we will take care of them.
GENERAL PATTERN WORKS
2233 Burk Street Cincinnati, Ohio

PRECISION FORM GRINDING

Specialists in grinding Circular and Flat FORM-TOOLS, FORM Counterbores, FORM Flat-Drills, and related types of FORM grinding. Also step-grinding of Tungsten and Molybdenum Rods.

Send Prints for Quotation and Delivery

J. & S. TOOL CO.—477 Main St.—E. Orange 1, N.J.
(Makers of J.&S. Radii & Engle Dressing Tools)

WIRE AND METAL SPECIALISTS

In round, flat, square and special shaped wire in all metals.

LARGE PRODUCTION CAPACITY
Plating and finishing.

EASTERN TOOL & MFG. CO.
BLOOMFIELD, N. J.

WANTED

SOURCE OF SUPPLY FOR METAL HOUSEHOLD CABINETS

A highly rated, NATIONAL sales organization, serving many hundreds of retail accounts, including the leading Department, Chain and Furniture stores, desires to contact MIDDLE WEST manufacturer, who has the FACILITIES to produce steel wardrobes and utility cabinets, also kindred items, with a view of PURCHASING the entire production, or any part thereof, on a contract basis. We have an exceptional record of more than 15 years of successful accomplishment with manufacturers of other products in the furniture and home furnishings field and can supply complete evidence of same. If you have the FACILITIES and EQUIPMENT to produce this type of merchandise in large quantities, contact us at once, even though you may not have manufactured these specific items pre-war, as we can supply complete production specifications, if so desired.

CW-300, AMERICAN MACHINIST
330 W. 42nd St., New York 18, N. Y.

INVENTIONS SOUGHT

Will pay cash or royalty for inventions that would sell to consumers for about $1.00 up to $100.00. Automotive parts and tools, Tire tools, any kind of repair tools, Household articles or small machines.

CONTRACTORS

Let us quote on your subcontracts. TURRET LATHES UP TO 3½" BAR FEED. Engine lathes up to 18" Swing. Milling machines up to 36" tables. Grinding, Welding and other supporting equipment.

DEMERS MACHINE PRODUCTS CO.
331 PLEASANT STREET WORCESTER, MASS.

(Additional Contract Work Ads on page 329)

POSITIONS VACANT

MECHANIC OR Tool Engineer—thoroughly familiar with tool setups and machining stainless, alloy, carbon steels. Required for customer contact work by steel distributor covering Eastern states. Write stating age, education, experience, draft status, availability, and salary expected. Replies strictly confidential. P-286, American Machinist, 330 W. 42nd St., New York 18, N. Y.

WANTED: Wisconsin corporation requires experienced man thoroughly familiar with machine shop practice, as assistant to general superintendent, technically trained engineer preferred. Excellent post-war opportunity. P-288, American Machinist, 520 N. Michigan Ave., Chicago 11, Ill.

WANTED: DETAIL Mechanical draftsman by machine tool builder in western Pennsylvania. Statement of availability required. Write giving experience, etc. to P-289, American Machinist, 330 W. 42nd St., New York 18, N. Y.

GRADUATE ENGINEER for metal stamping and assembling in small plant near Cincinnati, Ohio. Opportunity to grow with the business. Outline qualifications fully in letter addressed to P-304, American Machinist, 520 N. Michigan Ave., Chicago 11, Ill.

SENIOR AND Junior Industrial Engineers. Positions now open are permanent and afford successful applicants exceptional post-war opportunities. Starting salaries are high. Qualifications: Applicants for both senior and junior positions must be graduate engineers, either in industrial, chemical or mechanical engineering. Senior engineers (ages 28-33) must have had experience in 3 or more of the following; time studies, establishing standards, installing labor controls, estimating costs, installing wage incentive systems, handling methods improvement programs. Junior engineers (ages 21-27) without industrial experience will be considered. Inquiries, giving experience, marital and draft status and other pertinent information, should be directed to the Employment Manager, Union Bag & Paper Corporation, Post Office Box 570, Savannah, Georgia. Persons now engaged at highest skill in essential industry cannot be considered. Union Bag & Paper Corporation, Savannah, Ga.

(Additional Position Vacant ads on page 330)

EMPLOYMENT SERVICE

SALARIED POSITIONS—This advertising service of 35 years' recognized standing negotiates for high salaried supervisory, technical and executive positions. Procedure will be individualized to your personal requirements and will not conflict with Manpower Commission. Retaining fee protected by refund provision. Identity covered and present position protected. Send for details. R. W. Bixby, Inc., 366 Delaware Bldg., Buffalo 2, N. Y.

POSITIONS WANTED

TOOLROOM FOREMAN, long and varied experience metal stamping work, prefers a southern or western location. PW-280, American Machinist, 520 N. Michigan Ave., Chicago 11, Ill.

PLANT MANAGER, mechanical engineer, age 41, excellent character, sound judgment, successful record. Experienced in design, development, maintenance, production, labor relations, desires responsible position in small or medium sized company. Principals only. PW-305, American Machinist, 330 W. 42nd St., New York 18, N. Y.

SUPERINTENDENT—FACTORY Manager. A seasoned industrial executive of 50 with a background of 32 years in the machine and tool game. Engaged in the making of precision tools, dies, jigs, fixtures, gages, and special machinery. 16 years practical, 16 years executive experience. PW-306, American Machinist, 330 W. 42nd St., New York 18, N. Y.

REPRESENTATIVES WANTED

WANTED: TO Represent manufacture of mechanical and clerical products suitable for suburban and rural trade. Efficient sales, installation and maintenance services available, location Central Michigan. Bank reference. RW-292, American Machinist, 330 W. 42nd St., New York 18, N. Y.

(Continued on page 330)

TO ABLE, AMBITIOUS MEN

In Engineering, Manufacturing, Sales & Administration, we offer, AT NO CHARGE, a confidential, dignified opportunity of bringing their qualifications before interested employers.
Inquiries from management for key men are invited on a retainer or fee basis.

CURT E. PATTON PERSONNEL ENGINEERS
53 W. Jackson Blvd. Chicago 4

SEARCHLIGHT SECTION

(Classified Advertising)

EMPLOYMENT : "OPPORTUNITIES" : EQUIPMENT
BUSINESS : : USED OR RESALE

UNDISPLAYED ——RATES—— DISPLAYED

10 CENTS A WORD. MINIMUM CHARGE $2.00
Positions Wanted (full or part time individual salaried employment only) ½ the above rates payable in advance.
Box Numbers—Care of publication New York, Chicago or San Francisco offices count as 10 words.
Discount of 10% if full payment is made in advance for 4 consecutive insertions,

Individual Spaces with border rules for prominent display and advertisements.
The advertising rate is $6.50 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.
An advertising inch is measured ⅞" vertically on a column—3 columns—30 inches to a page.

WANTED

INDUSTRIAL CONTROL ENGINEER

We are interested in securing an electrical engineer to develop industrial control apparatus.

Applicant should be familiar with competitive designs, and have working knowledge of tests and working methods, Underwriter's requirements and NEMA standards for electric motor control.

Excellent opportunity to qualify for a permanent supervisory position in Engineering Department of an expanding organization well established in the automotive electrical and magnetic relay field. In applying give age and complete resume of experience.

R-B-M MANUFACTURING CO.
Division Essex Wire Corp.
LOGANSPORT INDIANA

WANTED

ENGINEERS MACHINE DEVELOPMENT

Graduate engineer or equivalent, experienced in the design and development of special and experimental machines. Men with creative ability required, experienced in such lines as automatic, semi-automatic, or ordnance equipment. Must be thoroughly acquainted with modern methods and shop practices and capable of developing new ideas in conjunction with modern mechanical laboratory facilities.

State age, marital status, details of education, experience, draft status, present salary and salary expected. Enclose recent photograph or snapshot.

Post-war opportunity.

Applicants must be able to obtain Statement of Availability.

E. I. du Pont de Nemours & Company, Inc.
Personnel Division
Wilmington 98, Delaware

TIME STUDY WORK

Man Required who has had a number of years experience in Time Study work, particularly in high speed metal cutting, and carbide tipped tool business. Also well qualified to estimate with reasonable accuracy the time required for each operation in production or fabrication of a given tool.

Detroit Company with more than 100 employees offers permanent position with good salary to one who qualifies. Please send complete details including years of experience.

P-303, AMERICAN MACHINIST
520 N. Michigan Ave., Chicago 11, Ill.

SENIOR TOOL ENGINEERS
CHIEF TOOL DESIGNER

Openings in Detroit & East. Postwar future. Large engineering firm. Give complete details in reply.

P-255, AMERICAN MACHINIST
520 North Michigan Ave. Chicago 11, Ill.

CONTRACT WORK

(Continued from page 328)

WANTED

PRODUCTION SUPERVISOR

To supervise manufacture of Electric Power Switchboards and Sheet Metal Products.

Essential Requirements

Thorough Manufacturing background; including experience in production and Job Shops.
Ability to design Tools—Dies—Jigs—Fixtures.
Knowledge of Electrical Circuits.
Ability to co-ordinate Tool Shop, Sheet Metal and Switchboard Departments.
Setting up of new facilities when required.
Submit resume. State Salary, Age—New York Factory.

P-302, AMERICAN MACHINIST
330 W. 42nd St., New York 18, N. Y.

PUNCH PRESS WORK WANTED

Automatic or Hand Feed. Simple Blanking Work from Coiled Stock on Customer's Dies Preferred.

VICTOR SPECIALTIES
6 Morris Street New Rochelle, N. Y.

MOULD MAKERS

Specializing in molds for the Rubber Industry also facilities for automatic screw machine work up to 11/16.

M & N Machine Tool Works
146 Orono Street Clifton, N. J.

(Continued from page 329)

REPRESENTATIVES AVAILABLE

DIAMOND TOOL manufacturers want local representatives in various territories. Already handling grinding wheels, grinding machinery, or other tools, or having excellent contacts in metal or plastic fabricating industry. Commission basis. RW-307, American Machinist, 330 W. 42nd St., New York 18, N. Y.

REPRESENTATIVES AVAILABLE

TOOL LINES wanted: Mechanical engineer, 9 years' experience as process engineer, 7 years manufacturing supervision; desires several small tool lines. Midwest territory preferred. Exceptionally good contacts in automotive industry. RA-264, American Machinist, 520 N. Michigan Ave., Chicago 11, Ill.

WELL FINANCED St. Louis machinery dealer desires additional lines of machine tools such as lathes, milling machines, shapers, drill presses, brakes, hack saws, home work shop woodworking equipment, and kindred lines. P. O. Box 3317 Progress Station, St. Louis, Missouri.

PATENT ATTORNEY

PATENTS, COPYRIGHTS, Booklet, "General Information concerning Inventions and Patents" and "Free Schedule" sent without obligation. Established 1915. Lancaster, Allwine & Rommel, Suite 453, 815-15th St., N.W., Washington 5, D.C.

Attention!

MANUFACTURERS

WHO WANT IMMEDIATE NATIONAL

DISTRIBUTION

VOLUME SALES

THROUGH

MILL SUPPLY and RADIO JOBBERS

If you want to sell your tools, machines, radio-electronic parts or other items *quickly* thru a well established industrial sales organization, get in touch with us at once.

RA 273, AMERICAN MACHINIST
520 N. Michigan Ave., Chicago 11, Ill.

Firm of Brazilian and American Machinery merchants specializing in machine tools and power plant equipment with warehouses in Philadelphia and Rio de Janeiro and offices in principal cities of Brazil desires exclusive representation for Brazil of leading manufacturers on stocking distributor basis. All export details handled by Philadelphia office. For details and financial rating write:

MR. J. DE V. F.
c/o THE O'BRIEN MACHINERY COMPANY
113 N. Third St., Philadelphia 6, Pa.

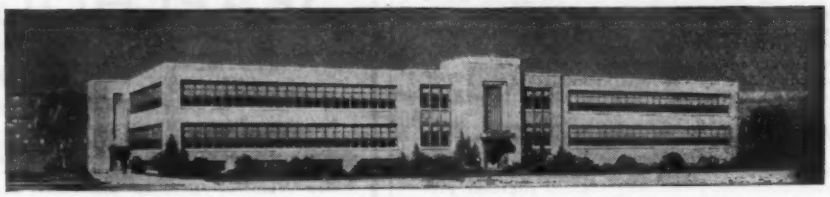
POSTWAR SWEDEN

offers a potential market for many lines of machine shop equipment. Swedish-American businessman, 34 years old, with excellent prewar sales record in Sweden, who for past four years has lived in United States and gained practical knowledge of modern American machine shop practice and business methods plans to return to Sweden in the near future as manufacturer's representative and desires to contact a few manufacturers of allied but non-competitive lines. For details of qualifications and references write:

RA-298, AMERICAN MACHINIST
68 Post St., San Francisco 4, Calif.

WANTED

PRECISION MACHINE DESIGNERS, DRAFTSMEN



MONARCH MACHINE TOOL CO., SIDNEY, O.

Builders of Precision Turning Machines Since 1909

WANTED

MACHINISTS
MACHINIST OPERATORS
TOOL MAKERS

Permanent full-time employment with America's leading manufacturer of oilfield equipment. Now building vital war materials but has a definite post war future. Living facilities available.

Cardwell Manufacturing Company, Inc.

Box 2001 Wichita, Kansas

TOOL DESIGNER

Old established Chicago West Side Company has opening for Tool Designer with practical toolroom and designing experience on dies, jigs and fixtures for mass production. Excellent opportunity with good post-war future. State age, experience, and salary expected.

P-296, AMERICAN MACHINIST
520 North Michigan Ave., Chicago 11, Ill.

REPRESENTATIVE WANTED

MANUFACTURER'S AGENT EXPERIENCED IN TOOL STEEL SALES FOR PITTSBURGH AND SURROUNDING TERRITORY. OLD WELL KNOWN COMPANY. COMPLETE LINE HIGH QUALITY TOOL STEELS.

RW-301, AMERICAN MACHINIST
520 North Michigan Ave., Chicago 11, Ill.

An OPPORTUNITY for
Manufacturers of
MACHINE TOOLS

To purchase a going division of a machine tool manufacturer. Limited number of items selling from $150 to $500 with complete tooling necessary to continuing manufacture and patents. Hundreds of satisfied users. Orders continually coming in. Write in strictest confidence to:

BO-295, AMERICAN MACHINIST
330 West 42nd St., New York 18, N. Y.

An old established business strategically located in the deep South, entered the field of metal stamping and forming for war contracts. They equipped their plant in an excellent manner, which can be used advantageously in post war work.

This company would be interested in carrying on this department under the management and possible financing of other competent parties, or making some mutually satisfactory arrangement.

Correspondence leading to an interview is invited

BO-297, AMERICAN MACHINIST
520 N. Michigan Ave., Chicago 11, Ill.

FOR SALE

(Additional For Sale ads on pages 331-337)

FOR SALE

1942 ONAN—Portable Generator—Model V-45 4½ K. W.—6.3—KVA—V-4 Cylinder Gas Driven—110 Volt 60 Cycle—220 Volt Single Phase—Serial No. 82-42601—Weather-proof Cover—Phone for information Baldwin 1217M or ME: 3-1546.

V. LANGDON
38 SOUTHARD ST. BALDWIN, L. I.

48"x48"x18' PUTNAM Planer 4 heads, 35 H.P. Motor.
102" Niles-Bement-Pond Co. Vertical Boring Mill, Two Swivel Heads, Rapid Traverse, Direct Geared Motor Drives, table 90"x7". 72" Clearance under rail.

These may be seen operating on actual work limited time. Low prices, to move quickly.

H. J. KOONTZ, MASSILLON, OHIO, Ph. 8180

UNIVERSAL TOOLS!

NATIONALLY ADVERTISED BRANDS AND PRICES

If It's A Tool—We have it, Can Get it, or It isn't made! PRICE LIST & ORDER BLANK FREE!!

UNIVERSAL TOOL COMPANY
O. B. Demattois, President
1527 Grand A.M. Kansas City, Missouri.

Immediate Shipment: Overnight by Air:
To Anywhere—U.S.A.

FORGING MACHINERY

One 7" and one 8" UPSETTING AND FORGING MACHINES—LATEST TYPE
One 20,000# STEAM DROP HAMMER
One set large size FORGING ROLLS

FS-299, AMERICAN MACHINIST
520 North Michigan Ave., Chicago 11, Ill.

WANTED

WANTED

New or used Rotary Double Pointed Tack Machine, as manufactured by A. H. Nilson Machine Company or equal.

M. D. GIARDINO
101 PARK AVENUE, NEW YORK 17, N. Y.
LExington 2-9288

WANTED

Broaches for square holes 3/16" to 1" by sixteenths. Material twice thickness of broach Cross Section.

ALLIED EQUIPMENT COMPANY
KEWANEE ILLINOIS

EVERY ITEM GUARANTEED AS REPRESENTED

FALK FOR DEPENDABILITY IN REBUILT MACHINERY

MORE VALUE FOR YOUR MONEY

• • • OUR INVESTMENT IS YOUR SECURITY

• • • SOUND RECONDITIONING

EXCEPTIONAL ITEMS FROM OUR MODERN STOCK*

SHEARS & BRAKES

Lennox Splitting Shear, 8" throat, ¾" cap.
Lennox Bevel Shear, ¾" cap.
Niagara #98 Production Power Brake & Folder. 72"x14 ga. cap. Equal to new.

PRESSES

#4 Bliss D.C. B.G. Forging 4" stroke. (2).
Toledo#34 Back Flywheel, arranged M.D. (2).
Toledo #1 O.B.I.
Bliss-"Stiles", No. 1, No. 2 Plain flywheel.
Waterbury-Farrel 105-ton O.B.I., M.D., hi-spd, power Press, double roll feed. 1" stroke, Bed 37" R to L, 20" F to B.
Bliss #16 Horn Press, with screw adjustable table.
Toledo #2½ O.B.I. Plain Flywheel.
Etna #12 Dble Act. Plain.
#65 Bliss Dble. Act. Cam.
#GC3 Ferracute Geared Dble Act. Cam.

Waterbury-Farrel Cold Header, double stroke, open die, ½" cap.
Manville Cold Header, single stroke, solid die, 3/16" cap.

BORING MILLS

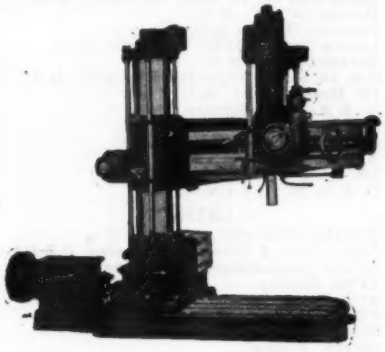
100" Niles-Bement-Pond Bor. & Turn. Mill.
48" Gisholt, vert. Boring & Turning Mill.
Horiz. #36 Landis-Rochester, 3½ Bar Floor Type—Floor Plate 72" x 120".
42" Bullard Vertical Boring Mill with side head; New Era Type.
54" Colburn Vertical Boring Mill.
#31 Lucas Horizontal Boring Mill, 3" bar.

GRINDERS

16" Heald Rotary Surface Grinder.
16" Persons-Arter Rotary Surface Grinder.
#4 Brown & Sharpe Universal Grinder.
#12 Greenfield Internal Hydromatic Grinder, sizematic type, complete with Tank and Pump. 15" swing, 5" hole, 4" dee.
Oliver Model 51 Drill Grinder; 1½" cap.
14"x36" Cincinnati Cyl., motor driven.
6"x32" Norton Cyl., overhead c/s drive.
12"x12"x36"—#2 Diamond Surface Grinder.

PLANERS

120"x72"x35' Betts, 4 Heads, M.D.
48"x48"x12' Putnam Heavy, 2 Heads, M.D.
30"x30"x12' American M.D., 2 Heads.
30"x30"x10' Cinn. Heavy Pattern, 2 Hds.
20"x20"x24" N.-B.-P., Planer Shaper, M.D.



Cincinnati-Bickford 5' Arm, 13" round column with air clamp. Oil grooved, tee slotted base, side base, with plain box table with #5 Morse Taper spindle. Motor drive.

DRILLING MACHINES

Bickford 4-spindle Rail Drill, #4 Morse Taper. Table 20" x 67".
Avey, 2 & 3 spindle Prentice, 4 spindle.
Henry & Wright, 6 spindle.
Woodward & Rogers, 6 spindle.
Fosdick 13", 4 spindle (2). 2 spindle (1).

RADIAL DRILLS

3' Dreses, 10" rd. col. QCG., M.D.
2½' Arm 9" Col. Cincinnati Bickford.
5' Arm 13" Rd. Col. Cinn. Bick. air clamp.
6' Arm 14" Col. Cincinnati Bickford.
3' 9" col. American, S.P.D.

MULTIPLE DRILLS

Fox #15H 54 spindle hydraulic feed.
Natco #D-5, 10 spindles #1 M.T.

MILLING MACHINES

No. OY Brown & Sharpe plain (2).
#3, #4 & #5 Cinn., High Power, Plain, S.P.D.
No. 0 Bickett Vertical Bench Miller.
#2-#1½ Brown & Sharpe Plain Millers.
No. 1½ Valley City Universal, Cone Dr.
No. 1 Brown & Sharpe, Plain (6).
P & W 2½" Duplex Spline Miller.
Hall Planetary Thread Miller 24".
No. 8 Lees Bradner Thread Miller.

LATHES

16 x 8 Hendey Arranged M.D.
14 x 6 Pratt & Whitney semi—Q.C.G.
Putnam, 26 x 12 Heavy Q.C.G., arr. for M.D.
American, 16 x 6 Q.C.G., Geared Head.
Hendey, 16 x 10 Q.C.G., Turner M.D.
Potter & Johnston #6A Automatic Chuckers; 3½" dia. hole in spindle (2).
Seneca Falls Tool Room, 14 x 6, Q.C.G.
20 x 10 Lodge & Shipley, G.H., M.D., Taper.
16"x6' Hendey Toolroom Lathe with relieving attachment, taper attachment, draw bar and collets. Geared Head.
16" Warner & Swasey Fox Brass (2).
16" Dreses Fox Brass.
Lodge & Shipley 16" x 8' 12-Speed Selective Geared Head.
Hendey 14"x6' Toolroom Lathe with taper, collets, M.D.

1—1¼" Cone 4-spindle Automatic Screw Machine, M.D., complete.

SHAPERS AND GEAR CUTTERS

26" Cincinnati Triple Geared, Belt Dr.
12" Schuchart & Schutte Gear Hobber.
#1 Adams Gear Hobbers, Belt driven (3).
14" Rockford crank shaper.
No. 2 Baker Keyseater.

MISCELLANEOUS

J. C. Miller Co. Lacq. Heater with acquistat.
Heat Treating Furnaces for the tool room.
Sleeper & Hartley #1 Wire coiling machine for making BX cable.
50 K.W. Moesta Gun Welder Transformer, portable, 25 cy. 440 volts.
Blake and Knowles 12x2x12 Simplex Type, Hydraulic Steam Pump, 2000 lbs. pressure with 80 to 125 lbs. steam, delivers 9 gallons per minute.
#228C Greenlee Vertical Hollow Chisel Mortizer, Power feed, M.D.
No. 7B High Speed Riveting Hammer, cap. ¾" to 1½". New this year.
Standard Automatic Drop Hammer, 300#.

HEADQUARTERS FOR POWER PRESSES

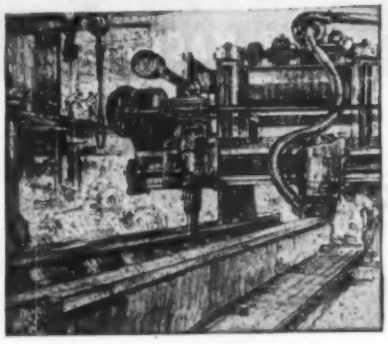
**The above list, selected from our current stock, is subject to prior sale or subsequent additions. Hence we urge your prompt inquiries on any of these machine tools or others in which you are interested.*

BUY FROM STOCK
Telephone
MAIN 6347-6348

FALK
MACHINERY COMPANY
Machinery Merchants

18 WARD ST.
ROCHESTER 5
N. Y.

ENGINEERED REBUILDING



By Simmons

Every machine listed in this column is in our warehouse at press time.

- 2¼" Bar LUCAS Horizontal Table Type Boring Mill, M.D.
- 2½" Bar CLEVELAND Horizontal Table Type Boring Mill, M.D.
- 5" Bar DETRICK-HARVEY Floor Type Horizontal Boring Mill, M.D.
- 24" BULLARD New Era Vertical Turret Lathe
- 42" BULLARD, NEW ERA, 1100 serial
- 42" N-B-P Car Wheel Borer, M.D.
- 66" N-B-P Vertical Tire Mill
- 10' CINCINNATI Vertical Boring Mill
- 4' HAMMOND Sensitive Radial Drill
- 6' CARLTON Motor-on-Arm, Plain
- 7' CARLTON Motor-on-Arm, Plain
- 8' N-B-P Motor-on-Arm, Plain
- #16 BLANCHARD Surface Grinder
- 33"x9" G & E Spur Gear Cutter
- 27" BRIDGEFORD Axle Turning Lathe
- 29" PUTNAM Axle Turning Lathe
- 42" PUTNAM Car Wheel Lathe
- #2 CLEVELAND Plain Miller, M.D.
- #5 B & S Plain Miller, M. D.
- #6 BECKER Vertical Miller, M. D.
- #10 N-B-P Heavy Vertical Miller
- 24"x24"x12' INGERSOLL Planer Miller
- 24"x36"x12' INGERSOLL Side Miller
- 30"x30"x10' NEWTON Slab Miller
- 42"x26"x12' INGERSOLL Planer Miller, Four heads, M.D.
- 30"x30"x12' N-B-P Planer, Two Rail Heads, 230 volt D.C.
- 48"x48"x24' N-B-P Planer, 3-heads, M.D.
- 48"x48"x32' GRAY Planer, Four Heads, 230 volt DC Reversing Motor Drive
- RT-40 SCHULTZ-NAUMANN Beam Shear
- 5" Capacity U.E.F. Alligator Shear
- 72" 105 Tons L & A Multiple Punch
- 8"x8"x⅝" Double Angle Shear
- 12" SELLERS Crank Slotter
- 20" SELLERS Crank Slotter
- 2" LANDIS Pipe Threader
- 6" BIGNAL-KEELER Pipe Threader
- 30' H & J Plate Planer, M.D.

SIMMONS ENGINEERED REBUILDING

SIMMONS MACHINE TOOL CORP.

1759 North Broadway, Albany, N. Y.

N. Y. Office: 50 East 42nd St.

CLOSEOUTS

BORING MILLS
HORIZONTAL

2½", 4" Binsee
4" Landis Horiz., Floor Type, M.D.

VERTICAL

66", 120" Niles
42" Bullard, M.D., 54" Colburn, M.D., 2 hds.

TURRET LATHES

Nos. 2A, 3A W.&S., 4½" hole, M.D.
24" Gisholt, 6¼" hole
Foster Nos. 4, 5, 6, 1B, M.D. Univ.
J. & L. 2¼x24", 3¼x36"
Acme 3¼" M.D.

GRINDERS

P. & W. 14", 18", B.B., Vert., M.D.
Blanchard 36", M.D.; Modern 12x48", M.D.
Norton Hydraulic 12x18", M.D.
Heald Nos. 55, 70, 72A3 Gagematic, M.D.
Norton 50"x28', M.D.
Gardner 72' disc, M.D.
Landis Type A 6x20" Hydraulic, M.D.
Bryant No. 12, M.D.
Nos. 50, 55, 60 Heald Int. Hydraulic, M.D.
12" Heald Rotary, M.D.
B. & S. No. 2 Surface, M.D.
Norton 10x36" Hydraulic, M.D.
Badger 24" Dbl. Opposed, M.D.
B. & S. No. 10, 11 Cyl.
No. 2 Cincinnati, Centerless, M.D.
B. & S. No. 1, 3 Universal

LATHES

McCabe 26-42"x14'
24x12' Boye & Emmes 3 step cone, D.B.G.
20"x14' Rahn-Larmon, raised to 24"
14"x6' Hendey
9" LeBlond Automatic
36x30' Putnam, M.D.
36x22' Putnam S.C.G., D.C.M.D.
32"x35' Wickes
Putnam 42x16', M.D.
30x26' L. & S. 12 speed M.D.
84"x28' Niles-Bement-Pond, 17' centers
P. & W. 1x18, 1¼x18 Automatic Lathes

AUTOMATICS

B. & S. No. 2, 6, 6F Hand Screw
B. & S. No. 00, 0, 2, OG
5 Spdle Davenport 9/16" cap.
Cleveland Model A ½", ⅝", 1¼", 2"
Cleveland Model B 1", 2"
Gridley 4¼" single spindle, M.D.
P. & J. 6A, M.D.
⅞" Cone 4 spindle
Gridley ⅞" 4 spindle

GEAR CUTTERS

No. 2, 12 Barber-Colman Gear Hobber
B. & S. No. 3-26", 4-36"
Gleason 11" Bevel
G. & E. 60" gear cutter

SHAPERS

15", 24" P & J.
16", 20", 26" Stockbridge

RADIALS

3', 4', 5' 6', 7', 8' American Triple Purpose
3', 3½', 4', 5' Cincinnati-Bickford
4' Mueller, M.D.; 4', 5' Western, S.P.D.

MILLING MACHINES

10" P. & W. Auto.
No. 2A Milwaukee, S.P.D.
No. 3S Cincinnati, S.P.D. rapid trav., M.D.
Nos. 1Y, 0Y, 3, 4, 5 B & S Plain & Univ.
B. & S. Nos. 12, 13, 13B
Hall Planetary Model D Thread Miller
Providence Planer Type 32"x8'
Becker Nos. 3, AB, 5, 6 Vert.
Nos. 3, 4, Cincinnati Vert.
P. & W. No. 12, 30 Profiler, M.D.
No. 4 B. & S. Universal
K. & T., B. & S. No. 3 Dbl. overarm, Timken Bearings
B. & S. No. 2, 3, Vert.
Milwaukee No. 2½B Vert.
Cincinnati No. 2 Universal
Kempsmith No. 1 Univ.

MISCELLANEOUS

Gorton No. 1S Engraving Machine
6 spindle Avey Drill, 15" overhang
McCabe ½" Flanger
Rochester No. 5B Hammer
Pels 6" Vert. Shaper
Pipe Machines, 4", 6", 8", M.D.
N.B.P. 15" Slotter, M.D
Burr Keyseater
⅜"x5' Plate Straightening Roll
4x4x⅝" Williams & White Angle Bending Roll
10' Erie Shear ¼" cap.
Natco No. 13 Multiple Spindle Drill

AARON MACHINERY CO.

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New York 12, N. Y.

QUALITY TOOLS

AUTOMATICS

½", No. 0G Brown & Sharpe
⅞" and 2" Cleveland Model B
1⅜" Gridley Model G 4 spindle
1⅝" New Britain 6 spindle
4½" Gridley 4-spindle Model H
No. 454 New Britain, 4-spindle chucking
14"x19" Fay automatic lathe
15" Sundstrand automatic lathe
Gisholt Simplimatic

DRILLS

Sensitive, all makes and types
21" Canedy Otto (New)
20", 21" & 24" Cincinnati upright
20" Barnes box column mfg.
22" Barnes 2-spindle, all grd, self oiling
4' Western radial, Timken bearing, M.D.

GEAR CUTTERS

No. 12 Barber Colman hobbers
No. 12 Bar. Col. long bed spinning
Nos. 7 and 21 Fellows shapers
No. 16HS Gould & Eberhardt hobbers
No. 1 Lees Bradner hobbers
64"x20" G & E spur gear cutter
26"x9" G & E spur gear cutter
11" Gleason straight bevel, segments & Gears
15" Gleason spiral bevel pinion and gear roughers
18" Gleason bevel testers and lappers
8" Red Ring spur gear lapper
Cimatool "Peerless" gear chamferers
Lipe 2-spindle gear chamferer

GRINDERS

No. 1 G Greeby Internal
No. 75 Heald Internal
Heald No. 72 automatic electric sizing internal
12"x36", 16"x36" & 16"x52" Landis
8"x20", No. 10 & 6"x32" No. 11 B.&S.
10"x24", No. 1 Brown & Sharpe univ.
10"x36" & 10"x50" Norton
12"x30" No. 2 B.&S. univ., M.D.
20" Gardner semi-automatic disc grinder
Ingersoll face milling cutter grinder, type EN85
Cincinnati face milling cutter grinder
Gisholt tool grinder
16"x32" Landis crankpin
No. 10 Blanchard surface
No. 1½ Cincinnati tool & cutter

FORGING EQUIPMENT

No. 2B Nazel air hammer, motor driven
No.1 Evans Ajax taper forging roll
3" Acme upsetter (forging machine)

LATHES

12"x8' Sebastian
14"x6' Mulliner
15"x6' Sebastian
18"x6' Reed Prentice
18"x8' Boye & Emmes
24"x12' Boye & Emmes
28", No. 3B Foster turret
22" & 28" Libby turret
28" Gisholt turret
8" and 12" Sundstrand Stub
13" Sundstrand automatic-stub

MILLERS & BORING MILLS

2½" Universal horizontal mill
3½" Blomquist Esk horizontal mill
4½" Universal horizontal mill
5" Barret cylinder borer
No. 3-B Milwaukee vertical miller
No. 3 Reed Prentice vert. miller & die sinker
No. 2 Kempsmith plain
No. 12 Brown & Sharpe Mfg. elec. drive
No. 3 Sundstrand bed type mfg. miller
48" Oesterlein tilted offset miller
42" Ingersoll continuous rotary
Type C Hall planetary thread miller
48" Newton C66A cont. rotary
No. 4 Lees Bradner univ. thread
4" Rice Barton double spline

MISCELLANEOUS

1400' Sullivan air compressor
4"x12" & 4"x36" Sundstrand dbl. end centerers
No. 3 LaPointe double broach
6" Bignall & Keeler pipe machine
No. 2 Standard screw press, 40 ton
36"x36"x16' Hamilton planer
67"x62"x35' Gray planer
90 KVA Fisher Body seam welder

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SAGINAW, MICHIGAN

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ENGINE LATHES

10"x20" Pratt & Whitney M.D. Bench Lathe, latest type
10"x3½' South Bend Underneath Motor Drive Tool Room Bench Lathe, latest
14"x6' Pratt & Whitney, cone
14"x8' Lodge & Shipley Selec., Hd., md., taper
14"x8' Sidney, cone
16"x6' Lodge & Shipley, cone
22"x16' Centers (22' bed) American 100 H.P. Input Super Lathe, with 100 H.P. D.C. motors, power rapid traverse, chip conveyor, etc.
24"x8' American Geared Head, m.d., taper
24"x12' American Geared Head, m.d., taper
24"x30' Schumacher-Boye, cone
26"x12' Schumacher-Boye, cone
27"x16' LeBlond type C Geared Head, m.d.
27"x16' LeBlond, cone
30"x13'6" Niles-Bement-Pond, m.d.
30"x26' Lodge & Shipley Selec. Hd., m.d.
30"x28' (20' centers) Niles Time-Saver, m.d., p.r.t., latest type
36"x10' Putnam, cone
36"x12' Wright, cone
36"x14' Boye & Emmes, cone
36"x28'6" (20' centers) Niles Heavy Duty, m.d., p.r.t., taper, latest type
36"x28'6" Niles H.D., m.d., p.r.t., pan, latest type, geared head
36"x36'6" (28' centers) Niles Heavy Duty, m.d., p.r.t., pan, 2 carriages, latest type, geared head
36"x24' American, m.d., 2 carriages, taper, geared head
42"x26' American, m.d., p.r.t., geared head
20"x8' American Geared Head, m.d., taper
20"x10' American Geared Head, m.d., taper

PLAIN MILLING MACHINES

No. 0B Cincinnati Plain Auto. model EA, m.d., latest
No. 000 Brown & Sharpe Plain, m.d., latest
No. 2B Brown & Sharpe Plain, m.d., in base, double overarm
No. 3B Brown & Sharpe Plain, m.d.
No. 3B Milwaukee Plain Double Overarm, m.d.
No. 4 Cincinnati Plain H.P., m.d.

VERTICAL MILLING MACHINES

No. 2 Brown & Sharpe, s.p.d.
No. 3 Cincinnati, m.d.
No. 3B Milwaukee, m.d. in base
No. 3B Milwaukee, s.p.d.
No. 3V Toledo, s.p.d.
No. 5 Brown & Sharpe, cone
No. 5 Jackson, m.d.
No. 6 Becker, cone
2 spindle Newton, m.d.

VALVE SEAT GRINDER

Cincinnati Valve Seat Grinder, m.d., cap. ⅜" valve stems

CYLINDER GRINDERS

No. 55 Heald, belt
No. 55 Heald, m.d.
No. 60 Heald, belt
No. 65 Heald, belt, 24" spindle

CYLINDRICAL GRINDERS—PLAIN

6x18" Landis, m.d.
6x32" Norton, m.d.
8x36" Cincinnati Saddle Type, m.d.
10x24" Landis, m.d.
10x36" Cincinnati Hydraulic, m.d., latest type
10x36" Landis, m.d.
10x48" Brown & Sharpe, belt
10x48" Landis Type C Hydraulic, m.d., latest type
10x52" Landis, m.d.
10x72" Landis, m.d.
12x36" Cincinnati, belt
12x36" Modern, m.d.
12x36" Modern, belt
12x42" Landis, belt

CYLINDRICAL GRINDERS—PLAIN (Continued)

12x48" Cincinnati Plain Self-Contained, m.d.
12x48" Modern, m.d.
12x72" No. 16 Brown & Sharpe, belt
12x96" Landis, m.d.
14x18" Cincinnati Plain Self-Contained, m.d.
14x48" Cincinnati Plain Self-Contained, m.d.
16x72" Landis, m.d.
16x216" Landis Type B Plain Hydraulic, m.d., latest type
20x120" Landis, with gap, m.d.
26x96" Landis, m.d.

CYLINDRICAL GRINDERS—UNIVERSAL

No. 2—12x30" Brown & Sharpe, belt
16x68" Landis, belt

RADIAL DRILLS

3' American Sensitive
3' Dreses Plain, gear box
3' Fosdick, sensitive
3½' American Triple Purpose, m.d.
3½' Cincinnati-Bickford, m.d.
4' American Triple Geared, m.d.
4' Cincinnati-Bickford Plain, m.d.
4' Niles-Bement-Pond Semi-Universal, m.d.
5' Carlton Plain, m.d.
5' Cincinnati-Bickford Plain, m.d.
5' American Triple Geared Plain, m.d.
5' Cincinnati-Bickford Plate Hole Driller, m.d.
5' Dreses Plain, m.d.
5' Niles-Bement-Pond Full Universal, m.d.
5' Prentice Plain, m.d.
6' Cincinnati-Bickford Full Universal, m.d.
6' Niles-Bement-Pond Semi-Universal, m.d.
6' Reed-Prentice, m.d.
6' Western, m.d.
7' Cincinnati-Bickford Plain, m.d.
8' American Triple Purpose, m.d. on arm

GEAR MACHINERY

No. 13 LS Fellows Gear Lapper, m.d.
No. 61 Fellows Gear Shaper, belt
3" Gleason Straight Tooth Bevel Gear Generator, m.d.
8" Gleason Mfg. Type Straight Bevel, m.d.
9" Pratt & Whitney Hydraulic Spur Gear Grinder, m.d.
11" Gleason Straight Tooth Bevel Gear Generator, m.d.
12" Gleason Straight Bevel, m.d.
48" Cleveland Gear Hobber, m.d.
No. 3-26" Brown & Sharpe Spur Gear Cutter
No. 3-36" Brown & Sharpe Spur
No. 3-26" Cincinnati Spur
No. 4-36" Brown & Sharpe Spur
No. 6-60" Brown & Sharpe Spur
No. 36S Gould & Eberhardt Spur Gear Cutter, m.d.
No. 36B Gould & Eberhardt Spur & Bevel, m.d., latest type
Cincinnati Gear Burnisher, m.d.
Gleason Spiral Bevel Gear Rougher
No. 2HS Lees-Bradner Spur & Helical Gear Grinder, m.d.
24" Cross Gear Tooth Rounder, m.d.

BROACHING MACHINES

Model VAS-5-42 Colonial Single Ram Hydraulic, m.d., latest type
No. 75 H.P. LaPointe Hydraulic, m.d., latest type, normal pull 37½ tons, max. stroke 150", cutting speed 2 to 17' per minute
No. 2 LaPointe, belt
No. 2 LaPointe of Hudson, belt
No. 3 J. N. LaPointe Double, belt
No. 4 LaPointe of Hudson, gear box
NEW Cincinnati Mill Broach, m.d., 10" spindle

BALL BEARING DRILLS

14" Canedy-Otto, m.d.
Allen Bench Type, m.d.
No. ½ Avey, m.d.
No. 1 Avey Bench Type, m.d.
No. 5M—16" Fosdick, m.d.
Mason Bench Type, m.d.

BALL BEARING DRILLS (Con't)

Providence Eng. Co. Model E, m.d.
Henry & Wright Class K, belt
2 spindle Sigourney, belt
4 spindle No. 3 Avey, m.d.
4 spindle Gardam, belt
4 spindle Kokomo, belt
6 spindle No. 3 Avey, m.d.

MULTIPLE SPINDLE DRILLS

No. 2 Baush, m.d., 16x30" head, hydraulic, 12 spindles
No. 2 Baush, m.d., 8 spindles
No. 3 Baush, m.d., 12 spindles
No. 3 Baush, m.d., 15 spindles
No. 11 Pratt & Whitney, belt, 10 spindles
No. 26C Fox Tapper, m.d., 50 spindles
3 spindle Rockford 12" Gang Drill, m.d.
4 spindle Foote-Burt Rail Drill, m.d.
4 spindle Harrington, belt
No. 16 Fixed Center Foote-Burt, m.d.

HORIZONTAL DRILLS

Love Bros., m.d., No. 4 Taper
5 spindle Detroit Semi-Automatic, belt
6 spindle National Acme, belt
8 spindle Hammond, m.d., hydraulic
Pratt & Whitney Rifling Machine, belt
No. 1 Pratt & Whitney 2 spindle Deep Hole, m.d.

UPRIGHT DRILLS

22" Barnes All Geared Self-Oiling
30" Rich H.D.
42" Barnes, m.d.
H3 Barnes Hydram, m.d.

AUTOMATICS

4 spindle ⅞" Cleveland Model M, m.d.
4 spindle 2" Cleveland Model M, m.d.
4 spindle 2¼" Cleveland Model K, m.d.
2¼" Gridley S.S., m.d.
2¼" Cleveland Model A, m.d.
3¼" Gridley S.S., m.d.
4¼" Cleveland Model A, m.d.
6" Cleveland Model A, m.d.
14" Fay, Flanders Type, m.d.
No. 6A Potter & Johnston, m.d.
No. 6C Potter & Johnston, m.d.
No. 6D Potter & Johnston, m.d., for brake drum work
No. 22 New Britain, tapping spindle
No. 23 New Britain, tapping spindle
No. 33 New Britain, tapping spindle

BOLT THREADING MACHINES

No. 2J Cleveland Double End Automatic Threader, m.d., with Landis Heads, cap. 2"
¾" Economy Style R Automatic Threading Machine, with Lanco Head
2 spindle 1" Landis Bolt Threading Machine, belt
1¼" Landis Triple Head, equipped with 4 blade bolt turning heads

VERTICAL BORING MILLS

24" Bullard New Era, m.d., side head
42" Bullard New Era, m.d., side head
42" Colburn H.D., 2 heads on rail
48" Cincinnati Rapid Production, m.d., 1 turret, 1 swivel head
52" King, m.d., 2 swivel heads
10' extended to 16' Betts, 2 swivel heads, m.d.
12' Niles, m.d., 2 swivel heads, p.r.t.

HORIZONTAL BORING MILLS

No. 21 Lucas, m.d., 2½" bar
2¾" bar Sargent, floor type
3½" bar Betts, m.d.
3½" bar Rochester Floor Type, m.d.
4" bar Detrick & Harvey Floor Type, m.d.
4" bar Lucas, m.d.
4" bar Niles, m.d.
4½" bar Niles, m.d.
5" bar Niles-Bement-Pond Floor Type, m.d.
5½" bar Niles, m.d.
5½" bar Niles-Bement-Pond, m.d.

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AUTOMATICS
1¼"—RA-6 Spindle Acme Gridley, New 1942
⅞" Cleveland Model M, four spindle
¾" Model F Gridley, four spindle
4" Model H Gridley Chucking, four spindle

DRILLS
No. C-13 Natco 16 spindle
No. 11 Natco 16 spindle
No. 3 Defiance, s.p.d., #5 Morse Taper
No. 24 Foote-Burt, s.p.d., #4 Morse Taper
6 Spindle Avey-matic, m.d.
28" Rockford sliding head, single spindle
24" Barnes Camelback
21" Canedy-Otto Single Spindle, m.d.
4' Cincinnati Bickford Radial, s.p.d.
Stecher Deep Hole, m.d., 2¼" capacity

GEAR CUTTERS
No. 5—60" Brown & Sharpe
No. 3—26" Brown & Sharpe
No. 5 Cincinnati
No. 6 Cincinnati
No. 6 Fellows Gear Shaper, m.d.
No. 13 Brown & Sharpe
No. 12 Barber-Colman Hobber
96" Gleason Spur & Bevel Gear Planer
30" Rochester Gear Tooth Rounder

GRINDERS
No. 2 Cincinnati Centerless
12" Heald Rotary Surface, s.p.d.
No. 18 Blanchard Surface, m.d.
No. 13 Brown & Sharpe Universal
No. 2 Cincinnati Universal
No. 70 Heald Internal
No. 72A3 Heald Gagematic
No. 60 Heald Internal
10x30 Landis Cylindrical
10x36 Norton Cylindrical
10x36 Hill-Clarke Cylindrical
No. 16 Brown & Sharpe Cylindrical
No. 30A Brown & Sharpe Cylindrical
76" Rogers Knife Grinder

LATHES, ENGINE
12"x10' American, c.d.
14"x10' Lodge & Shipley, c.d.
16"x 8' Pratt & Whitney, c.d.
18"x 8' American, c.d.
18"x10' Lodge & Shipley, c.d.
22"x12' Lodge & Shipley, c.d.
8"x60" Fitchburg Lo-Swing, g.h.

LATHES, TURRET
No. 4L Gisholt, 9¼" Hole in Spindle, g.h.
No. 2A Warner & Swasey, g.h.
2¼"x24" Jones & Lamson, g.h.
28" Libby, g.h.
No. 5A Potter & Johnston, g.h.
No. 4 Warner & Swasey, c.d.
No. 2 Warner & Swasey, c.d.
42" Bullard New Era V.T.L.

MILLS
No. 2B Milwaukee Universal, m.d.
No. 4 Cincinnati Plain, s.p.d.
No. 3 Cincinnati Plain, s.p.d.
No. 1½B Milwaukee, s.p.d.
No. 1½A Rockford Plain, c.d.
No. 2½B Milwaukee Vertical, s.p.d.
No. 0-S Cincinnati Vertical, m.d.
No. MM-3 U.S. Multi-Miller, m.d.
4" Pratt & Whitney Spline
No. 5 Becker Vertical, c.d.

MISCELLANEOUS
No. 6 Beatty Double End Punch & Shear
12" Williams Pipe Machine
4" Stevens Vertical Slotter
16" Betts Vertical Slotter
Kane & Roach Roll Forming Machine

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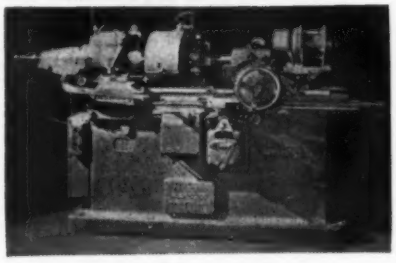

1—Heald 72A3 Int. Grinder, sw. over tbl. 15¼", max. diam. hole 5½", with AC elect. equip., Redhead grind. spins.

★ GRINDERS
1—22" P. & W. Vert. Sur. Grinder, B.B. tbl. wks. sur. 18"x46", tbl. overall 34"x8", max. tbl. trav. 48", vert. adj. spin. 14", will take grind. wheel 22" diam. x 1¾" face, with oil pump and tank arr. for M.D.
1—Norton 15"x15"x96" Opensides Surf. Grind., mag. chucks, M.D.
1—Bezley No. 218 opposed Grinder.
1—Hanchett Series 300 Hyd. Surf. Grinder.

★ BORING MILLS
1—Bullard 42" Vert. Boring Mill, capas. 44" diam., 33" under cross rail, 42½" under turret face 42⅝" tbl. diam. with 3 jaw comb. or 4 jaw indpdt. chuck built-in, 12 tbl. speed changes 3.3 to 56 RPM, 8 pos. indpdt. feed changes for each hed., vert. hed. move 27", will face 44", turret diam. 16⅝", 5 faces 2¾" holes, side hed. vert. move 25", horz. 21" top tbl. to underside side hed. slide 25".
1—Bullard 24" New Era Prod. Vert. Bor. Mill, with side hed.
1—60" Colburn Boring and Turning Mill., sw. 62", max. dist. under cross rail 46", tbl. diam. 60", vert. trav. of rams 32".
1—Giddings & Lewis Knee Type No. O Horz. Bor. Mill, diam. spin. bar 3½", Morse taper No. 5, long trav. 20", vert. adj. 25½", max. dist. tbl. to spin. cen. 26", dist. face spin. to bor. bar: support 60½", tbl. 23¾"x45", M.D.

★ MILLERS
1—1B Milwaukee Horz. Pl. Miller, all grd., tbl. long feed 22", cross 6", vert. 19", tbl. size 28⅜"x9½" overall, M.D.
1—1A Milwaukee Miller, dbl. overarm, tbl. long feed 22", cross 8", vert. 19" size of tbl. 38⅜"x9½" overall, M.D.
3—Becker 4B Millers, wk. sur. tbl. 20"x10¼", mtzd. dist. btw. spin. & neck 15"
3—P. & W. Thread Millers 4½"x12", 6"x48", 6"x132".

★ ENGINE LATHES
1—American 24"x12' QCG, grd. hd. heavy pattern high duty Engine Lathe, sw. over bed, 26½", sw. over compound rest slide, 17½", lgth. of bed, 12', dist. btw. cens. 84", hole thru spin. 2-16".
2—Hendey 14"x6' Yoke head, QCG Eng. Lathes, with taper attmpts. M.D., collets, dist. btw. cens. 36".
1—Lodge & Shipley 16"x8' QCG Eng. Lathe M.D. Dist. btw. centers 57".
1—Bradford Machine Tool Co. 14"x9' QCG Eng. Lathe, 4 step cone single bk. grd., M.D. dist. btw. cens. 34"

★ TURRET LATHES
5—Acme No. 1 Semi-Univ. Turret Lathe, M.D., 2⅝" thru spin. 20¾" swing.
1—W. & S. 3A Univ. 4¾" hole thru spin., Timken bearing.
1—W. & S. 3A Univ. 4¾" hole thru spin. pl. bearing.
2—J. & L. Turret Lathes 2¼" and 3¼".
1—W. & P. Auto No. 12 Prec. Tapper and Thread. Machine, Mod. M-2140, prac. new.

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DEPENDABLE USED MACHINES

BULLARD 24" Vert. Turret Lathe
GISHOLT 42" 2 hd. Vert. Boring Mill—P.R.T.
CINCINNATI BICKFORD 3½' Radial Drill—M.D.
GLEASON 3" & 6" Bevel Gear Generators—Double Tool
GLEASON 10" & 15" Spiral Bevel Gear Generators
GLEASON 1" Straight Bevel Gear Generator—M.D.
NORTON 24"x240" Plain Grinder
ARTER 8" Rotary Surface Grinders
LODGE & SHIPLEY 30"x26' Selective Grd. Hd. Lathe
WARNER & SWASEY 3A Universal Turret Lathe
CINCINNATI No. 3 Vert. Miller—High Power
BROWN & SHARPE No. 3 Vert. Miller—P.R.T.
WOODWARD & POWELL 60"x60"x 20' 4 hd. Planer—Rev. M.D.
CINCINNATI 36"x36"x10' 4 hd. Planer—Rev. M.D.
MOREY No. 12M 2 spindle Vert. Profiler
SAUNDERS 8-18" Pipe Threader
TREADWELL 12" Pipe Machine
PRATT & WHITNEY 6" Vert. Shaper
PRATT & WHITNEY 10" Vert. Shaper
DILL 18" Slotter
GISHOLT Precision Balancing Machine
ESPEN LUCAS Cold Saw—12" cap.
SLEEPER & HARTLEY Coil Winding Machine

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MILLER, PLAIN—MILWAUKEE No. 2-B, Double Over-Arm, M.D.
PLANER, METAL—WOODWARD & POWELL 30"x30"x8', 1 rail head, 1 side head.
SAW, METAL CUTTING BAND—Marvel No. 8, cap. 18"x18".
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2—Gridley Model H 4-spindle Chuckers, M. D.
1—No. 5 Cincinnati Plain Mill
1—No. O B & S Turret Lathe
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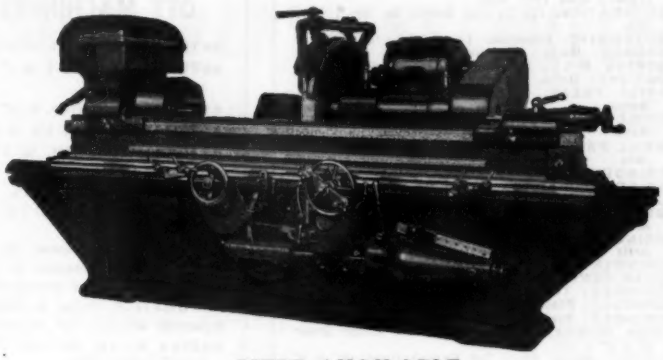
Modernized
CYLINDRICAL GRINDERS *for* SUPER-GRINDING *and* MICRO-FINISH



SIZES AVAILABLE

10x24	14x36	16x50
10x36	14x50	16x72
10x50	14x72	18x96
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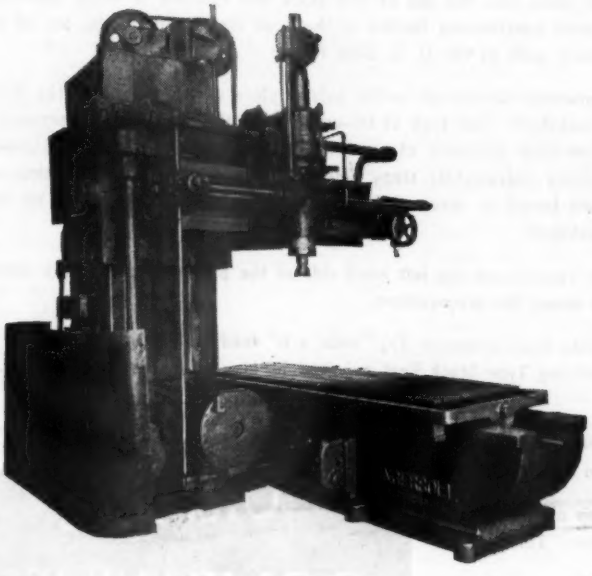

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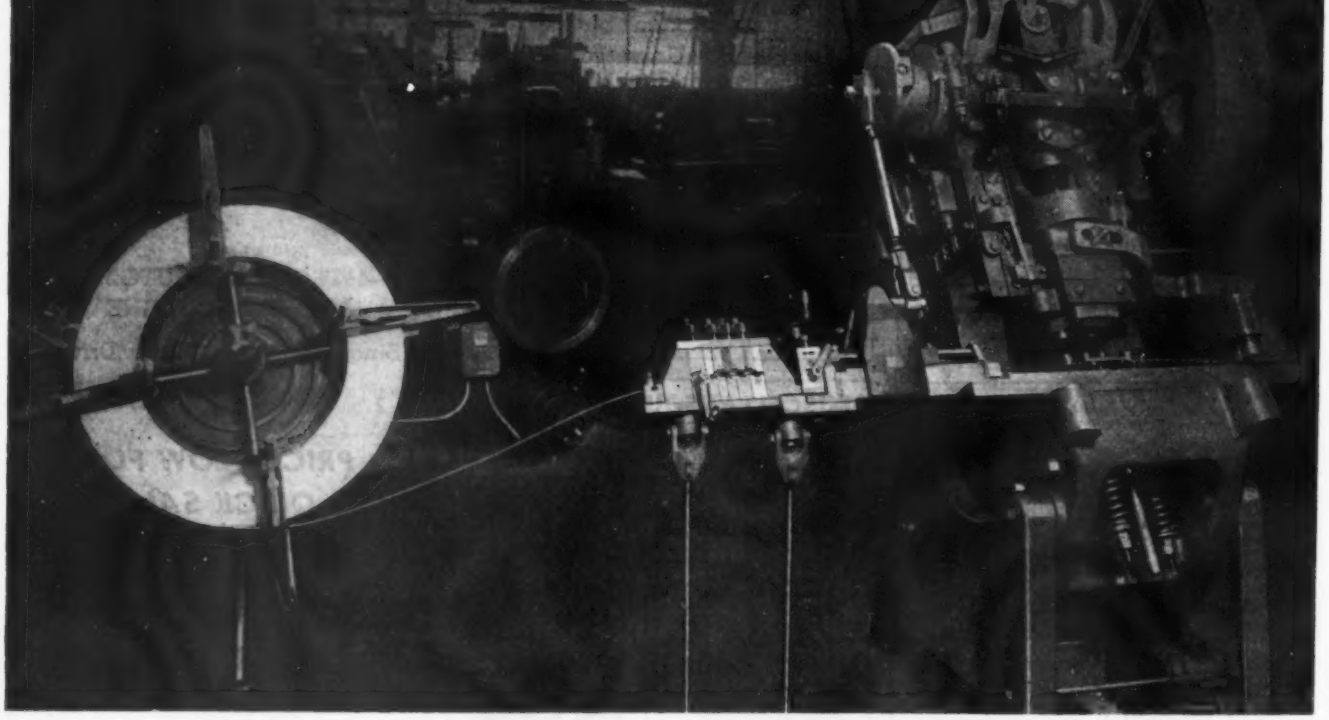


ADVERTISERS INDEX

	Page
Abbott Ball Co.	184
Abrasive Co.	313
Abrasive Machine Tool Co.	250
Accurate Bushing Co.	278
Acme Aluminum Alloys, Inc.	166
Aeromark Co.	226
Adams Co.	216, 252
Air Reduction	320, 321
Allegheny Ludlum Steel Corp.	279
Allen-Bradley Co.	185
Allen Manufacturing Co.	204
Allis-Chalmers Manufacturing Co.	17, 32
Allison Tool & Engineering Co.	258
Almond Mfg. Co., T. R.	264
Aluminum Co. of America	57
American Chain & Cable Co., Inc.	295
American Engineering Co.	256
American Gas Furnace Co.	325
American Laundry Machinery Co.	326
American Metal Hose Branch . Anaconda Copper Mining Co.	189, 190
American Optical Co.	197
American Screw Co.	198
American Tool Works Co.	16
Ampco Metal, Inc.	206
Angier Corp.	248
Anker-Holth Manufacturing Co.	264
Armstrong-Blum Manufacturing Co.	58
Armstrong Brothers Tool Co.	68
Arter Grinding Machine Co.	246
Automatic Machine & Tool Co.	298
Avey Drilling Machine Co.	216
Ball & Roller Bearing Co.	196
Bantam Bearings Div. Torrington Co.	194
Barber-Colman Co.	39
Bardons & Oliver, Inc.	85
Baumbach Manufacturing Co., E. A.	222
Baush Machine Tool Co.	237
Bay State Abrasive Products Co.	286
Behr-Manning Corp.	301
Blake Co., Edward	314
Blanchard Machine Co.	53
Blank & Buxton Machinery Co.	258
Bodine Corp.	247
Boston Gear Works, Inc.	219
Boyar-Schultz Corp.	226
Bradford Machine Tool Co.	244
Braun Gear Co.	218
Bridgeport Machines, Inc.	239
Brown & Sharpe Mfg. Co.	33
Bryant Chucking Grinder Co.	36
Bullard Co.	35
Bunting Brass & Bronze Co.	210
Capewell Manufacturing Co.	160
Carboloy Co.	292, 293
Card Manufacturing Co., S. W.	322
Carlton Machine Tool Co.	242
Carpenter Steel Co.	306
Chase Brass & Copper Co.	174
Chicago Tool & Engineering Co.	288
Cincinnati Bickford Tool Co.	95
Cincinnati Electrical Tool Co.	314
Cincinnati Gear Co.	216
Cincinnati Gilbert Machine Tool Co.	246
Cincinnati Grinders Incorporated	10, 11
Cincinnati Lathe & Tool Co.	260
Cincinnati Milling Machine Co.	4, 5
Cincinnati Planer Co.	78

	Page
Cincinnati Shaper Co.	98
Cities Service Oil Co.	179
Clark Controller Co.	188
Cleveland Hobbing Machine Co.	60
Cleveland Pneumatic Tool Co.	263
Climax Molybdenum Co.	153
Cone Automatic Machine Co.	27
Consolidated Machine Tool Corp.	49
Continental Machines, Inc.	249
Continental Tool Works, Div. of Excello Corp.	45
Coulter Machine Co., James	254
Covel Mfg. Co.	229
Crafts Co., Inc., Arthur A.	324
Criterion Machine Works	288
Cross Company	62, 63
Curtis Universal Joint Co., Inc.	204
Cushman Chuck Co.	297
Dalzen Tool & Mfg. Co.	243
Danly Machine Specialties, Inc.	226
Darwin & Milner, Inc.	196
Davis & Thompson Co.	246, 302
Davis Keyseater Co.	250
Dayton Rogers Mfg. Co.	298
Deepfreeze Div. Motor Products Corp.	315
Defiance Machine Works, Inc.	251
DeLaval Separator Co.	227
Delta Mfg. Co.	231, 232, 233, 234
DeSanno & Son, Inc., A. P.	167
Desmond-Stephan Mfg. Co.	306
Detroit Bevel Gear Co.	214
Detroit Tap & Tool Co.	151
DeVlieg Machine Co.	56
Diamond Machine Div. Amer. Engrg. Co.	256
Disston & Sons, Inc., Henry	289
Dixon Crucible Co., Joseph	312
Dodge Mfg. Corp.	207
Dow Chemical Co.	181
Dumore Co.	259
Dykem Co.	260
Eastern Machine Screw Corp.	302
Electric Auto-Lite Co.	67
Elgin National Watch Co.	323
Ericsson Screw Machine Products, Inc.	208
Errington Mechanical Laboratory	290
Etna Machine Co.	222
Ettco Tool Co.	319
Excello Corp.	28, 29
Fafnir Bearing Co.	195
Fairfield Mfg. Co.	214
Falk Corporation	217
Fawick Airflex Co., Inc.	300
Federal Bearings Co., Inc.	87
Federal Products Corp.	283
Fellows Gear Shaper Co.	8, 9
Firth-Sterling Steel Co.	80, 81
Fitchburg Grinding Machine Corp.	48
Fitzsimmons Co.	192
Foote-Burt Co.	88
Fosdick Machine Tool Co.	54
Gallmeyer & Livingston Co.	240
Ganschow Gear Co.	216
Gates Rubber Co.	191
Gear Grinding Machine Co.	257
Gear Specialties Mfrs.	216

	Page
General Electric Co.	43, 317
General Engineering & Mfg. Co.	242
Geometric Tool Co.	265
Gilmore & Co., F. F.	308
Gisholt Machine Co.	76, 86
Gleason Works	3
Gorham Tool Co.	276
Goss & deLeeuw Machine Co.	250
Grant Gear Works	218
Grant Mfg. & Machine Co.	222
Gray Co., G. A.	26
Greenfield Tap & Die Corp.	55
Grobet File Corp.	288
Gulf Oil Corp.	83
Hamilton Tool Co.	262
Hammond Machinery Builders	248
Hanson Whitney Machine Co.	172
Harrison Radiator Div. General Motors Co.	327
Hardinge Brothers, Inc.	37
Hartford Special Machinery Co.	218, 298
Haskins Co., R. G.	244
Haynes Stellite Co.	287
Heald Machine Co.	2nd Cover
Hendey Machine Co.	228
Hill Acme Co.	34
Hobart Brothers	192
Hoefer Mfg. Co.	260
Holman Reamer Co.	302
Hones, Inc., Charles A.	324
Hydropress, Inc.	221
Hyster Company	309
Independent Pneumatic Tool Co.	94
Ingersoll Milling Machine Co.	84
International Nickel Co., Inc.	169
J & S Tool Co.	290
Jessop & Sons, Inc., Wm.	262
Jessop Steel Co.	220
Johnson Machine Co., Carlyle	186
Johnson Bronze Co.	187
Jones & Lamson Machine Co.	6, 7
Jones & Laughlin Steel Corp.	38
Kalamazoo Tank & Silo Co. Machine Tool Div.	258
Kearney & Trecker Corp.	71
Kempsmith Machine Co.	91
Kennametal, Inc.	75
Kester Solder Co.	296
Kingsbury Machine Tool Co.	79
King Machine Tool Co.	92
Knight Machinery Co., W. B.	261
Knu-vise, Inc.	318
Kux Machine Co.	322
L. W. Chuck Co.	272
Lamson & Sessions Co.	200, 201
Landis Machine Co.	14, 15
Landis Tool Co.	18, 19
LaPointe Machine Tool Co.	253
LeBlond Machine Tool Co., R. K.	3rd Cover
Lees-Bradner Co.	20, 21
Leland Gifford Co.	196
LeMaire Tool & Mfg. Co.	218
LePel High Frequency Lab., Inc	303

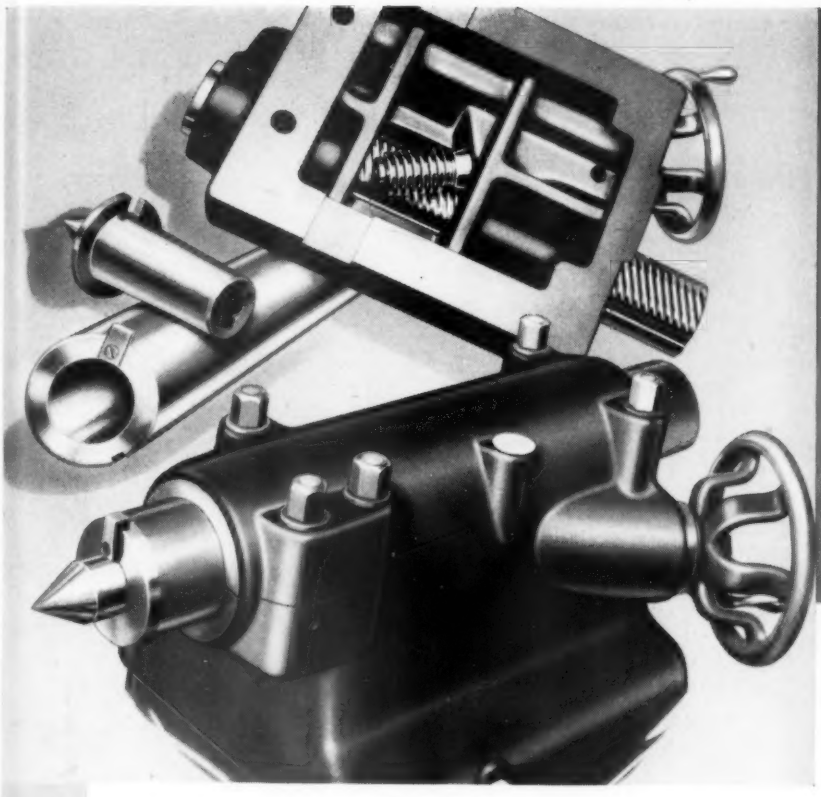
ADVERTISERS INDEX

	Page
Liberty Planers, Inc.	240
Lincoln Park Industries, Inc.	149
Linley Brothers Co.	250
Lodge & Shipley Machine Tool Co.	143
Logan Engineering Co.	241
Lubriplate Div. Fiske Bros. Refining Co.	310
Lucas Machine Tool Co.	250
Luers, J. Milton	324
McGraw-Hill Book Co., Inc.	184, 310
Macklin Co.	275
Mahon Co., R. C.	199
Mallory & Co., Inc., P. R.	255
Master Gauge Co.	322
Matthews & Co., James H.	226
Mattison Machine Works	235
Meisel Press Mfg. Co.	216
Metal Carbides Corp.	284
Metro Tool & Gage Co.	299
Michigan Tool Co.	147
Mid-West Abrasive Co.	93
Midwest Tool & Mfg. Co.	270
Miller-Knuth Mfg. Co.	260
Millholland Machinery Co., W. K.	242
Mitts & Merrill	254
Monarch Machine Tool Co.	24, 25
Monarch Steel Co.	192
Morey Machinery Co., Inc.	238
Morton Salt Co.	326
Murchey Machine & Tool Co.	291
Murray Mfg. Co., D. J.	246
National Acme Co.	30, 31
National Broach & Machine Co.	65
National Lock Washer Co.	193
National Machine Tool Co.	306
National Twist Drill & Tool Co.	277
Newark Gear Cutting Machine Co.	218
New Britain-Gridley Machine Division, New Britain Machine Co.	140
New Departure Div. General Motors Corp.	155
Niagara Machine & Tool Works	223
Nicholson & Co., W. H.	288
Nicholson File Co.	161
Nichols & Sons, W. H.	163
Noble & Westbrook Mfg. Co.	308
Norma-Hoffmann Bearings Corp.	164, 165
Norton Company	22, 23, 59
Oakite Products, Inc.	308
Ohio Gear Co.	215
Ohio Oil Co.	66
Oliver Instrument Co.	245
O'Neil Irwin Mfg. Co.	226
Orange Roller Bearing Co., Inc.	205
Osborn Manufacturing Company	162
Page Steel & Wire Div., Amer. Chain & Cable Co., Inc.	295
Peerless Machine Co.	236
Peninsular Grinding Wheel Co.	304, 305
Philadelphia Gear Works, Inc.	213
Pipe Machinery Co.	271
Pope Machinery Corp.	285
Portage Machinery Co.	254
Porter-McLeod Machine Tool Co., Inc.	252
Potter & Johnston Machine Co.	89
Pratt & Whitney Div., Niles-Bement-Pond Co.	69
Production Machine Co.	244
Producto Machine Co.	264
Progressive Welder Co.	145
Quaker Chemical Products Corp.	90
Railway Express Agency Air Exp. Div.	222
Randall & Stickney	306
Ready Tool Co.	314
Reed-Prentice Corp.	82
Remington Rand, Inc., Systems Div.	316
Republic Gage Co.	290
Reynolds Metals Co., Aluminum Div.	170, 171
Rhoads & Sons, J. E.	180
Rivett Lathe & Grinder, Inc.	46
Robbins & Myers, Inc.	209
Rustless Iron & Steel Corp.	175, 176, 177
Ruthman Machinery Co.	202
Scherr Co., Inc., George	70
Scully Jones & Co.	266
Sheffield Corp.	157
Shore Instrument & Mfg. Co., Inc.	278
Sidney Machine Tool Co.	74
Sier-Bath Gear Co., Inc.	212
Sisalkraft Co.	166
Smit & Sons, Inc., J. K.	269
Smith & Mills Co.	254
Snyder Tool & Engineering Co.	64
Socony-Vacuum Oil Co., Inc.	311
South Bend Lathe Works	72
Springfield Machine Tool Co.	52
Square D Co.	203
Stahl Gear & Machine Co.	214
Standard Conveyor Co.	159
Standard Oil Co.	267, 268
Standard Pressed Steel Co.	182, 202
Standard Tool & Gage Corp.	307
Staples Tool & Engineering Co.	61
Starrett Co., L. S.	138
Sterling Grinding Wheel Division	294
Sticht Co. Inc., Herman	278
Stow Manufacturing Co.	180
Strand Co., N. A.	240
Strong Carlisle & Hammond Co.	196
Stuart Oil Co., Ltd., D. A.	302
Sunnen Products Co.	230
Syncro Devices, Inc.	296
Taft-Peirce Mfg. Co.	168
Taylor Machine Co.	218
Texas Co.	96
Thomas Hoist Co.	318
Thompson Grinder Co.	77
Timken Roller Bearing Co.	4th Cover
Torrington Co.	222
Torrington Co., Bantam Bearings Div.	194
Trabon Engineering Corp.	183
Tubular Micrometer Co.	302
Tuthill Pump Co.	208
Union Carbide & Carbon Corp.	287
Union Twist Drill Co.	42
U. S. Broach Co.	274
United States Products Co.	284
United States Steel Corp.	178
United States Steel Supply Co.	178
U. S. Tool Company, Inc.	338
United Welding Co.	312
Universal Boring Machine Co.	242
V. & O. Press Co.	222
Vanadium-Alloys Steel Co.	280, 281
Van Keuren Co.	47
Van Norman Co.	12, 13
Vard, Inc.	273
Vascaloy Ramet Corp.	324
Victor Machinery Exchange, Inc.	206
Vitrified Wheel Co.	324
Vulcan Tool Corp.	44
Waldes Koh-I-Noor, Inc.	211
Walker Co., Inc., O. S.	278
Waltham Machine Works	238
Waltham Screw Co.	202
Warner & Swasey Co.	50, 51
Wendt-Sonis Co.	158
Western Felt Co.	184
Westinghouse Electric & Mfg. Co.	40, 41, 73
Wheelock, Lovejoy & Co., Inc.	208
Willson Products, Inc.	310
Wilson, K. R.	224, 225
Wilson Mechanical Instrument Co.	254
Woodworth Co., N. A.	282
Wyckoff Steel Co.	173
Wyzenbeek & Staff, Inc.	284

Classified Advertising

SEARCHLIGHT SECTION

Classification	Page
BUSINESS OPPORTUNITIES	330
CONTRACT WORK SECTION	328, 329
Bergen Machine & Tool Co. Inc.	328
Bridgewater Screw Products Co.	328
Demers Machine Products Co.	328
Eastern Tool & Mfg. Co.	328
General Pattern Works	328
Greist Mfg. Co.	328
J. & S. Tool Co.	328
M & N Machine & Tool Works	329
National Tool & Machine Co.	328
Nilson Machine Co., A. M.	328
Old Colony Engineering Co.	328
Specialty Machine Tool & Die Co.	328
Thomas & Skinner Steel Products Co.	328
Vahl Engineering Co.	328
Victor Specialties	329
EMPLOYMENT SERVICE	329
PATENT ATTORNEY	330
POSITIONS VACANT	329, 330
POSITIONS WANTED	329
REBUILDING SERVICE	332, 334, 335
Hill-Clarke Machy. Co.	335
Indianapolis Machy & Supply Co., Inc.	334
Simmons Machine Tool Corp.	332
SELLING OPPORTUNITIES	329, 330
WANTED TO PURCHASE	330
USED EQUIPMENT	330-337
Aaron Machinery Co.	332, 335, 337
Allied Equipment Co.	330
Beal & Co., Joseph	336
Bennett Machinery Co.	335
Botwinik Bros. of Mass., Inc.	334
Brooks, B. D.	336
Brownell, Hazard	337
Cleereman Machine Tool Co.	336
Cincinnati Machinery & Supply Co.	335
DeWitt Tool Co.	335
Dony Machinery Co., D. E.	334
Eastern Machinery Co.	333
Emerman Machinery Corp.	337
Factory & Mill Supply Co., Inc.	335
Falk Machinery Co.	331
Galbreath Machinery Co.	335
Giardino, M. D.	330
Hill-Clarke Machinery Co.	335
Hasco Machinery Co.	334
Hyman & Son, Joseph	335
Indianapolis Machy & Supply Co., Inc.	334
Koontz, H. J.	330, 336
Langdon, V.	330
Kings County Machinery Exchange	336, 337
Miles Machinery Co., Inc.	332
Morey Machinery Co., Inc.	334, 336
Osborne & Sexton Machinery Co.	336
Ott Machinery Sales, Inc.	336
Paul's Motor & Machy. Supply	336
Reynolds Machinery Co.	337
Saunders Machinery Exchange	336
Simmons Mach. Tool Corp.	332
Strong, Carlisle & Hammond Co.	337
United Pipe & Supply Co.	336
Universal Hydraulic Machy. Co.	336
Universal Tool Co.	330
West Penn Machinery Co.	337
Zeeve & Co., Alex.	334



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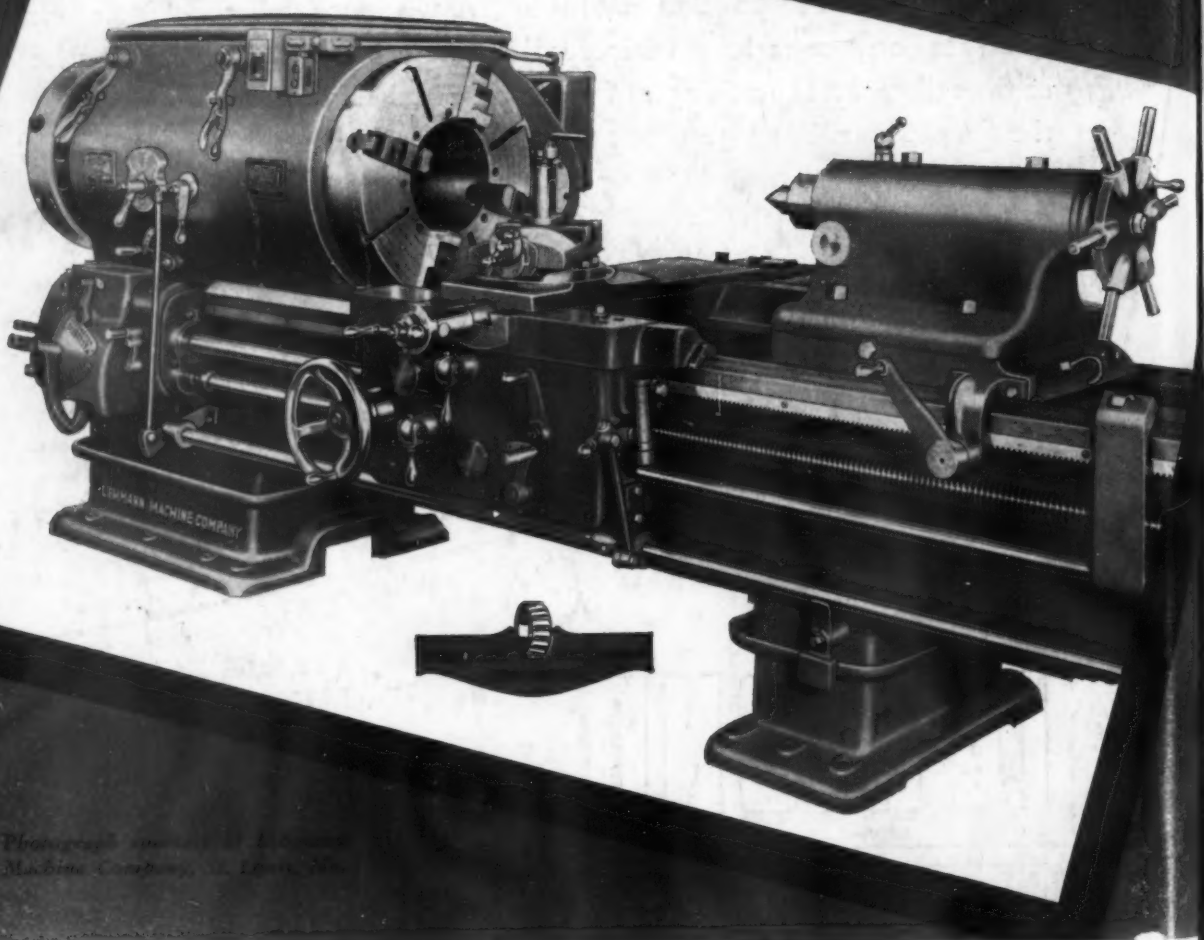

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